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DISEASES

OF

THE STOMACH.

DISEASES

OF

THE STOMACH.

ON

THE ORGANIC DISEASES

AND

FUNCTIONAL DISORDERS

OF

THE STOMACH.

BY

GEORGE BUDD, M.D., F.R.S.,

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PHILADELPHIA:
BLANCHARD & LEA.
1856.

WM. S. YOUNG, PRINTER, PHILA.

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THE following Lectures, with the exception of Lecture XIV., have before appeared in a scattered manner in one of the weekly medical journals. Those on Self-digestion of the Stomach after Death and on Simple Ulcer were delivered at the College of Physicians, as the Croonian Lectures, in the spring of 1847, and were soon afterwards published in the "Medical Gazette." The remaining Lectures on the Organic Diseases of the Stomach were published in the "Medical Times and Gazette," in 1853, and the Lectures on the Functional Disorders of the Stomach in the same journal in 1854. They are now republished with such additions and corrections as my subsequent experience has suggested.

DOVER STREET,
October, 1855.

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ON THE

ORGANIC DISEASES

AND

FUNCTIONAL DISORDERS OF THE STOMACH.

LECTURE I.

Introduction.—Difficulties attending the study of stomach disorders—Self-digestion of the Stomach, or changes that take place in the coats of the Stomach after death from the action of the gastric juice.

THE stomach, whose disorders we are about to consider, is the foundation or root of all the complex apparatus that ministers to the nutrition of the body. It is, as Shakspeare termed it, "the storehouse and the shop of the whole body;" but it is more than this, for it not only receives and holds in store the crude materials for the sustenance of the body, but, by the agency of its peculiar juice, helps to dissolve those materials and to prepare them for conversion into the living blood. Any serious disorder of its functions necessarily affects in some degree the after-processes, and tends to contaminate or divert the life-stream at its source. To ensure, then, the proper nutrition of the body, and, consequently, the due maintenance of its manifold powers, the functions of the stomach must be rightly performed. But in man, fundamental and important as they are, the functions of the stomach are liable to be disordered by various conditions and in various ways, so that derangements of the stomach constitute a large proportion of human ailments.

Notwithstanding their frequency, however, and their obvious importance, and the great attention which has in consequence been

paid to them by physicians in all times, our knowledge of them, it must be confessed, is still very scanty and vague. The reason that our knowledge is so defective is, that the study of these derangements is extremely difficult. Considering such of them only as are dependent on some appreciable change of structure, the physician has great impediments to encounter.

Where the organic change is not such as to cause a palpable tumour, there are no direct means of ascertaining the physical condition of the organ, while the sick man is living. The stomach is not visible, like parts on the surface; it cannot be explored by the sense of hearing, like the organs within the chest; its outline can seldom be distinctly felt, like that of the liver or the spleen; and its secretions are not poured out separately and unmixed for our inspection, like those of the kidney. The nature of its diseases must be inferred almost wholly from the functional disturbance they occasion. But the functions of the stomach are more readily deranged than those of any other secreting organ, and by a greater variety of conditions. Irritation of the brain, the passing of a gall-stone, obstruction of the bowels, disease of the kidney or of the uterus,—will cause vomiting as frequent and distressing as organic disease of the stomach itself. Any sudden emotion, a febrile condition, however induced, various unhealthy conditions of the blood,—will suspend or derange the secretion of its solvent juice.

Again, the structural diseases of the stomach—at least, of its mucous membrane, which is the source of its digestive power,—have been less elucidated by morbid anatomy than those of most other organs. When inflammation, for example, occurs in solid organs, as the brain, the liver, or the kidney,—or in the closed sacs of the body, as the peritoneum, or the pleura, where it does not immediately destroy life, it leaves, for the most part, some permanent traces. If the body be opened at any future time, these traces are seen, and to a certain extent understood. It is not so with mucous membranes. The effusions to which inflammation gives rise are in them poured out on an open surface, and discharged from the body; and often, even when the disease is of long continuance no permanent changes of structure result,—at least, no changes which our senses can appreciate.

This remark applies, indeed, to the mucous membrane of the air-tubes or of the urinary bladder and urethra, as well as to that of the stomach. But when inflammation occurs in the air-tubes or in the urethra, the matters effused are thrown off unmixed for our

inspection, and from their varying characters the progress or decline of the malady may be traced. The secretions to which inflammation of the stomach gives rise are, on the contrary, mixed with various matters,—with whatever is taken as food, or drink, or physic; and with the different secretions which are poured into the stomach and intestines to work those important changes in the food in which digestion consists.

But, in the study of these diseases, there is yet another difficulty. The stomach presents various appearances, independent of disease, —according to the condition of the person when death occurred, and the time of year, and the mode of death, and the time after death at which the body is examined; and several of these appearances are very like the products of disease, and have, indeed, been generally confounded with them.

Before, then, we can discriminate the changes of structure which are due to disease, we must be able to recognise, and rightly to interpret, these other changes that occur without it.

By far the most important of these is the change which the stomach undergoes after death from the solvent action of its own proper juice. This change exists in greater or less degree in a large proportion of the bodies we examine; and unless we are familiar with its characters, it is impossible that we can distinguish the effects of inflammation and other changes of nutrition of the mucous membrane. A study of this is not only a necessary preliminary to the study of the diseases of the mucous membrane, but it also throws light on the circumstances which promote the secretion of the gastric juice, and on various functional disorders to which the stomach is liable.

It is to this change, therefore, that I shall first call your attention.

I need hardly remind you that it was John Hunter who first announced that the stomach itself may be dissolved or digested after death, by its own proper juice.

Earlier pathologists, from Morgagni downwards, had occasionally remarked extreme softness of the mucous membrane—indeed, of all the tissues in the splenic end of the stomach,—but they had all regarded this change as the result of disease. Hunter was led to the discovery of its real nature by finding it in an extreme degree in some persons killed by accident, in the midst of health; in whom, therefore, it could not be thus explained. He says:—"The first time that I had occasion to observe this appearance in such as died of vio-

lence, and suddenly, and in whom, therefore, I could not easily suppose it to be the effect of disease, was in a man who had his skull fractured, and was killed outright by one blow of a poker. Just before this accident he had been in perfect health, and had taken a hearty supper of cold meat, cheese, bread and ale. Upon opening the abdomen, I found that the stomach, though it still contained a good deal, was dissolved at its great end, and a considerable part of its contents lay loose in the general cavity of the belly. This appearance puzzled me much.

"The second time was at St. George's Hospital, in a man who died a few hours after receiving a blow on his head which fractured his skull.

"From these two cases, among various conjectures about so strange an appearance, I began to suspect it might be peculiar to cases of fractured skull; and therefore, whenever I had an opportunity, I examined the stomach of every person who died from that accident; but I found many of them which had not this appearance.

"I afterwards met with the same appearance in a man who had been hanged."

In some of the cases that fell under the observation of Hunter, the digestive action had extended much further than through the stomach. After having dissolved the stomach at the usual place, it had partly dissolved the adjacent side of the spleen, and had dissolved the adjacent portion of the diaphragm quite through, so that the contents of the stomach were found in the cavity of the chest, and had even corroded, in a slight degree, the surface of the lung at that part.

Hunter found softening of the stomach of the same kind in some of the animals that were the subjects of his experiments on digestion, when he did not open them immediately after death. These animals, after having been fed with various kinds of food, were all killed at different stages in the process of digestion.

He procured also the stomachs of a great variety of fish—which when they come into our hands have usually died from violence—in a state of perfect health, and with their stomachs full: and in many of these he found the digesting part of the stomach in the same dissolved state as the digested part of the food.

Hunter concluded that digestion of the stomach after death is most common, and takes place to the greatest extent, in persons who die violent deaths; but that it occurs very frequently, though

then usually in less degree, where death arrives more slowly from disease. He says, indeed, "There are few dead bodies in which the stomach at its great end is not in some degree digested; and one who is acquainted with dissections can easily trace these gradations."

These observations of Hunter excited great interest at the time, not only from their novelty and startling character, but also from the new views they unfolded of the process of digestion, which was then very imperfectly understood. They showed, indeed, conclusively, as the sagacious mind of Hunter at once perceived, that digestion depends essentially on something secreted by the coats of the stomach and poured into its cavity; and that this solvent menstruum,—this gastric juice,—though indebted to the stomach for its secretion, is yet capable of acting independently of it.

The experiments of Hunter were repeated and varied, among others by Spallanzani, who when Hunter's paper fell into his hands, was engaged with his experiments on digestion. Spallanzani's experiments, which were all made on the lower animals, and which were multiplied and varied with his characteristic patience, confirmed the main fact announced in Hunter's paper, that digestion goes on after death, and that the stomach itself may then be digested by its own proper juice. Spallanzani, probably from making his observations in winter, did not for some time, among a great number of stomachs which he examined, find a single one which had its great end *perforated* from digestion of its coats. He found, he tells us, the mucous membrane dissolved more or less, and especially in fish, but never observed that entire destruction of all the coats of the stomach which had been noticed by Hunter. His observations, however, taught him a fact, of which Hunter was not aware,—a fact, namely, that a certain degree of *heat* is requisite to develope the solvent power of the gastric juice.

Soon after the publication of Hunter's paper, observations on softening of the stomach in man were published by several physicians. In these observations the appearances of the softened stomach are very faithfully described, but no one seems to have met with the change so frequently as Hunter. Most writers, from making their dissections chiefly in winter, or from only recognising the change when it existed in an extreme degree, inferred that digestion of the stomach after death occurs but seldom and in cases that must be considered as exceptions to the general rule.

At length, the interest which the subject at first excited died

away; few observations on this remarkable change were published; and when softening of the stomach was met with, it was regarded by most physicians, as it had been before the time of Hunter, as the result of disease. In France, indeed, where morbid anatomy was most assiduously cultivated, but where the writings of Hunter were less generally read than in this country, many of the most enlightened pathologists seemed never to have even suspected that it could have any other origin; so that, in 1830, when Dr. Carswell again mooted the subject in Paris and exhibited softened stomachs of rabbits that were killed soon after feeding and opened some hours after death, almost as much interest—I may say, indeed, *surprise*—seems to have been excited, as was caused by the first publication of the observations of Hunter.

From this time the renewed interest had its former effect, and for a few years, essays on the subject frequently appeared. Observations, indeed, of softening of the stomach, or of digestion of the stomach after death, have occasionally been published up to this time; some very admirable ones recently, by Mr. Wilkinson King, in one of the late numbers of "Guy's Hospital Reports." But pathologists, in general, seem not to be aware how frequently the stomach undergoes this change. It has been supposed by many to occur only after violent deaths; and when occurring, as it often does, in other circumstances, it has been either overlooked or has been regarded as the effect of disease.

M. Louis, for instance, one of the most accurate observers of our time, has published a special essay on softening (with thinness) of the mucous membrane of the stomach; and in his elaborate work on Phthisis has given, in the statistical form usual with him, the exact proportions in which he found this change, after death by acute and by chronic diseases; but when these works were first published, he seems not to have suspected that such a change could take place except from disease. To any one, however, who is familiar with the appearances produced by the gastric juice in cases like those which first arrested the attention of Hunter, where death happens suddenly in the midst of health, it will be evident enough, from the mere perusal of M. Louis' descriptions, that in most of the instances to which he refers, the softening of the stomach occurred after death, and was the mere effect of the solvent power of the gastric juice.

The question then arises—How is it that in this age of inquiry, when morbid anatomy has been studied with a zeal and success in-

comparably greater than in any former time, the truth set forth by Hunter has been so slow to make its way?

The reason apparently is, that the change in question varies in frequency and degree with many circumstances,—with the time of year, with the heat of the room in which the body is kept, with the circumstances of death, and with the previous state of health; —so that the observations of one man did not tally with those of another; what one found frequently, another, whose observations were made in different circumstances, found but seldom. The variable and disturbing circumstances were not considered, and each man naturally distrusted observations that appeared to be contradicted by his own.

No one seems to have observed this change so frequently as Hunter; but the truthfulness of Hunter's mind, and the simplicity and candour of his statements, prevent us from supposing that in this respect he was guilty of any exaggeration. The fact is, that the solvent powers of the gastric juice require a certain temperature, and increase as the temperature rises from the lowest point at which they act at all to the temperature of the blood,—the temperature at which they act in the living body. Hunter's observations were probably made during a hot summer, when, by reason of the high temperature, softening or digestion of the stomach after death was unusually frequent. During the past summer, which was a very hot one, my attention was casually drawn to this subject, and from the middle of May to the middle of August I carefully examined the stomach in all the bodies that were opened in the King's College Hospital. In several instances the mucous membrane in the great end of the stomach was completely destroyed, and in a very large proportion it had been clearly acted on, more or less by the gastric juice. I renewed my observations in October, but the change, at least in a striking degree, was then much less frequent.

Digestion of the stomach by the gastric juice is generally observed, as I have already intimated, in the big end of the stomach; where any liquid that may be in the stomach collects after death, and where the mucous membrane is thinner, and less firm, and usually less protected by mucus, than in other portions.

The first effect of the gastric juice is to render the mucous membrane thinner and softer, so that it may be readily removed by the pressure of the fingers; and at the same time to *blacken the blood* contained in its vessels. If the capillaries of the mucous membrane were full of blood when the action of the juice commenced, the

softened membrane gets a grayish or brownish cast, and is paste-like and opaque. If, on the contrary, the capillaries of the mucous membrane were empty, the softened tissue is rendered somewhat gelatinous and transparent; and should the larger branching vessels in the submucous cellular tissue be full, these are blackened, and thus rendered conspicuous, and, in consequence, are plainly seen through the thin and softened and gelatinized membrane.

Precisely similar changes take place in albuminous tissues out of the stomach, when they are submitted to the action of the gastric juice at the temperature required for digestion. If the substance contains little blood or fat, like white of egg or lean boiled meat, it is rendered more or less transparent or gelatinous, as it softens; if, on the contrary, it contains much blood and fat, like raw or roasted flesh, it is transformed into a brownish paste.

In a still higher degree of this *post-mortem* digestion of the stomach, the mucous membrane most acted upon has the form and appearance of a thin layer of mucus or paste. The underlying tissues are next dissolved and removed, until, as in the instances which first attracted the attention of Hunter, all the coats are eaten through and the contents of the stomach escape into the general sac of the peritoneum. The edges of the opening thus made, to borrow the description of Hunter, "appear to be half dissolved, very much like that kind of dissolution which fleshy parts undergo when half-digested in a living stomach, or when dissolved by a caustic alkali,—viz., pulpy, tender, and ragged."

In some instances, the portion of the diaphragm which lies in contact with the dissolved end of the stomach gets dissolved in its turn, and the contents of the stomach pass into the cavity of the chest. The spleen, the lungs, and other organs with which the solvent juice is thus brought into contact, are in such cases more or less corroded by it.

Digestion of the stomach occurs, as I have before remarked, in the highest degree in its big end; and it is only in this part, where the liquid contained in the stomach chiefly collects after death and where the mucous membrane is thin, that *perforation* from this cause ever takes place: but when this end of the stomach is perforated, or its mucous membrane much softened, other portions of the organ exhibit in less degree the action of the same agent. The edges of the folds, which the organ, when contracted, always exhibits in its pyloric portion, are the parts that here become softened the first. If the mucous membrane was empty of blood, these folds appear as

whitish semi-transparent lines, or rather narrow bands, in which the mucous membrane is palpably thinner and softer than in their intervals, where it is more protected—partly perhaps by the mucus which lodges in the furrows—from the action of the dissolving agent. If, on the contrary, the mucous membrane was congested, the softened bands have a brownish tint, which contrasts still more strongly with the pink uninjured membrane around them.

It sometimes happens, as was shown by Mr. King, in a paper published in the 7th volume of "Guy's Hospital Reports," that, after death, some of the liquid in the stomach regurgitates through the cardiac orifice (mainly, perhaps, through the contraction of the abdominal muscles in the *rigor mortis*,) and lodges in, and dissolves, the lower end of the œsophagus. Here, as towards the pyloric end of the stomach, the projecting edges of the folds are acted upon first. The coats of the œsophagus may be completely dissolved, one after another, like those of the stomach; and in this way, also, some of the contents of the stomach may pass into the cavity of the pleura. A case of this kind occurred to Sir A. Cooper, who related the particulars of it to Mr. King. "The œsophagus," he said, "was dissolved, and the bread and cheese were found extravasated in the chest."

The under or back part of the œsophagus, on which the solvent fluid rests, is the part that is most acted on in such cases; and from the lower end of the œsophagus lying to the left of the vertebral column, it follows that where perforation takes place the opening leads into the *left* pleural sac.

When the œsophagus is thus dissolved or corroded by the gastric juice, the great end of the stomach is always dissolved or corroded also.

As digestion of the stomach after death does not occur in all cases, and as, when it does take place, it occurs in very different degrees in different cases, the question arises—On what conditions does this digestion depend?

Two conditions obviously necessary are,—1st, that the stomach at the time of death should contain a certain quantity of active gastric juice, or, at least, of muriatic or lactic acid, which make with the coats of the stomach a digestive mixture; and 2ndly, that the stomach should be kept for some hours after death at the temperature required for artificial digestion.

The first condition is very generally fulfilled in persons who are killed by accident, in the midst of health, and soon after a meal.

The instances, before related, which so strongly arrested the attention of Hunter, were of this kind.

It was early remarked by Hunter, that softening of the stomach does not occur in all cases of violent death; and it was inferred from his observations, and the inference was strengthened by the experiments of Dr. W. Philip and Dr. Carswell, that it only takes place when death happens soon after a meal; that is, while the process of digestion in the stomach is actively going on.

It is, indeed, only at such times that the stomach, under ordinary circumstances, contains any gastric juice. While the stomach is empty of food, the fluid which moistens its surface is not acid, and has no peculiar solvent power. This point was conclusively established by the observations of Dr. Beaumont on the stomach of St. Martin, which could be seen and examined through a large fistulous opening in the wall of the belly; and one of the most interesting circumstances witnessed by Dr. Beaumont in his long-continued observations was the outpouring of the gastric juice on mechanical irritation of the inner surface of the stomach, especially on the introduction of food. The following is the account he gives of one of his experiments. (Exp. 63.)

"Jan. 19th.—At 9 o'clock, A. M., coats of stomach perfectly healthy and clean. No appearance of morbid action; tongue clean, and every appearance of perfect health. There was no free fluid in the gastric cavity until after the elastic tube was introduced, when it began slowly to distil from the end of the tube, drop by drop, perfectly transparent and distinctly acid. I obtained about one drachm of this kind, and then gave him a mouthful of bread to eat. No sooner had he swallowed it than the fluid commenced flowing more freely from the tube, and I obtained two drachms, less pure, however, with saliva and mucus mixed with it, and slightly tinged with yellow bile. The surface of the protruded portion of the villous coat at this time became covered with a limpid fluid, uniformly spread over its whole surface, distilling from myriads of very fine papillary points, and trickling down the sides. After letting him rise and walk about two or three minutes, I again introduced the tube, and obtained about two drachms more of very pure gastric juice, making in the whole five drachms."

Dr. Beaumont states, that in more than two hundred observations he never found any gastric juice in the empty stomach; and he considered mechanical irritation of the mucous membrane, or the more natural and more efficient irritation by food, to be necessary for the secretion of it.

The secretion of the gastric juice is, to use a word much in vogue, a *reflex* function, whose ordinary excitant is the impression of food on the mucous membrane of the stomach. The nervous influence, so excited, causes the sudden and rapid outpouring of the gastric juice, just as the nervous influence called into action by mechanical irritation of the conjunctiva causes a flow of tears. Now the flow of tears may be excited, not only by mechanical irritation of the conjunctiva, but by mechanical irritation of the mucous membrane of the nostril, or of the mouth; and by certain medicines, like iodide of potassium, which are excreted at those surfaces; and by mental emotion. The flow of urine, again—an instance in some degree analogous,—may be increased by emotion, as well as by direct irritation of the kidney itself.

The question then arises—May not the same thing happen for the gastric juice? May not the outpouring of this be occasionally determined by other influences than the presence of food in the stomach; or, at least, by nervous impressions on other parts? Many considerations lead to the inference that it may.

Spallanzani obtained some gastric juice from his own stomach by tickling the fauces, and thus exciting vomiting, in the morning before breakfast, when the stomach, we may presume, was empty of food. By exciting vomiting twice in succession, he obtained in this way juice enough to undertake some experiments, of which he has given an account. That the fluid was actually the peculiar solvent juice of the stomach was shown by its dissolving and preventing the putrefaction of meat.

A case having great interest as regards this question was brought under my notice last summer.

A gentleman, forty years of age, while riding in the Park at six o'clock in the afternoon of the 21st of May, was thrown from his horse and, by the fall, fractured his skull. He was taken to his house, where he lay motionless and insensible till half-past one P. M. on the following day, when he died.

On examination of the body, which was made eighteen hours after death, by my colleague, Mr. Fergusson, the great end of the stomach was found to be completely dissolved, and other portions of the organ exhibited in less degree the usual appearances caused by the solvent action of the gastric juice. The portion of the diaphragm in contact with the great end of the stomach was likewise dissolved quite through, so that there was a large opening from the stomach into the cavity of the left pleura. This cavity contained about a

pint and a half of dark grumous fluid, not unlike coffee-grounds, consisting chiefly, I presume, of partially digested or altered blood.

Now the accident happened, as far as I could learn, and I made many inquiries on this point, before dinner, when the stomach was probably quite empty; and, according to the statement of Mr. Fergusson and others in attendance upon the patient, it completely destroyed the power of swallowing, so that nothing whatever was taken into the stomach from the time of the accident to his death.

Here, then, was digestion of the stomach in the highest degree after a violent death, which did not occur, however, suddenly and soon after a meal, as in the instances of similar destruction of the stomach recorded by Hunter and others, but, on the contrary, at the end of nearly twenty hours passed in a state of coma, and after an unusually prolonged fast.

The question, then, naturally arises, was the secretion of the large quantity of gastric juice which must have existed in the stomach at the time of death determined by the shock of the accident, or by the subsequent irritation of the brain which the accident occasioned? And is there not still some ground for the suspicion which Hunter early entertained and then abandoned, that digestion of the stomach is especially apt to occur after death from fracture of the skull? It is clear that if gastric juice should be secreted under such circumstances, and in an empty stomach, its action on the coats of the stomach after death would be unusually great, because it would not then be absorbed and neutralized by food, and would have nothing but the unprotected stomach to dissolve.

But, as I have already stated, it is not only after violent death in the midst of health that digestion of the stomach takes place: it occurs also, and not unfrequently, though then usually in much less degree, in persons who die of disease. The reasons of this difference of degree are obvious. In a state of health, the secretion of gastric juice is determined by the presence of food in the stomach, and the quantity of juice secreted varies with the quantity of food which it has to dissolve. At the end of two or three hours after a meal, the stomach is either empty or the solvent power of its juice has been in a great measure expended in digesting the food. Hence it is that digestion of the stomach is usually found in the highest degree when death happens suddenly, soon after a full meal.

Now, in most diseases the appetite is impaired, and much less

food is usually taken than in health, more especially as their fatal termination approaches. In most diseases, too, the power of digestion suffers—the gastric juice secreted, after a given quantity of food, is less in quantity, and has less solvent power, than in health. On both accounts, the digestion of the stomach itself after death occurs less frequently, and usually in much less degree.

There are, however, some striking exceptions to this general rule. In persons who die of phthisis, and after death from some other diseases, the mucous membrane of the stomach, in its great end, is frequently found much softened by the gastric juice; and now and then all the coats of the stomach are destroyed at that part in almost as great extent as when death happens suddenly, in the midst of health, soon after a meal.

A consideration of these cases raises some interesting questions, but I have not time to enter on it to-day. I shall, therefore, reserve what I have to say on this subject until I have the honour of addressing you again, and shall now proceed to speak of the other conditions necessary for *post-mortem* digestion of the stomach.

One requisite for this, as was clearly shown by the experiments of Spallanzani, is a certain temperature. Spallanzani found that the gastric juice, which acts strongly at the temperature of the living body, loses its solvent powers, and is no longer antiseptic, when the temperature falls below a certain degree,—a conclusion which has since been fully confirmed by the experiments of Dr. Beaumont. Digestion is probably most rapid at the temperature of the living body, about 100° Fahrenheit; it goes on briskly at the temperature of the atmosphere in summer; but at the temperature of 60° Fahrenheit, (to judge by an experiment of Spallanzani,) it becomes very slow and feeble. This accounts for the circumstance that digestion of the stomach after death is most commonly met with in summer. Much, however, must depend on the temperature of the body at the time of death, and on the rapidity of cooling which takes place afterwards, which must of course vary, whatever be the season, with the place in which the body is kept, and with the nature of the material, whether woollen or otherwise, in which it is wrapped.

Another condition necessary for artificial digestion, and therefore required for the digestion of the stomach after death, is that the digestive fluid should be acid. It was proved by Schwann, in his experiments on artificial digestion with *rennet*, that the digestive fluid is inert when neutralized by carbonate of potash, but

recovers its solvent power on the addition of the proper quantity of hydrochloric acid.

The digestion of the stomach after death may be occasionally prevented by ammonia given just before death to relieve the sense of sinking. If the juice be in small quantity, it may be neutralized, and thus rendered inert after death, by the transudation of the alkaline serum of the blood.

Alcohol, again, renders the digestive principle inert; and if this be given freely just before death, as it often is in this country, in the vain attempt to relieve the sense of sinking, it may not be absorbed before the circulation ceases, and may prevent the subsequent solution of the stomach, which the gastric juice would otherwise occasion. A great number of medicines also suspend or much diminish the solvent powers of the gastric juice, and, if given just before death, may prevent or retard the subsequent digestion of the stomach.

The influence of medicines in retarding digestion, which may now be clearly ascertained by artificial digestion with rennet, has not yet been sufficiently studied. The importance of knowledge on this point is very obvious, when we consider how frequently medicines of different kinds, many of which are slowly absorbed, are given when there is food in the stomach, and when digestion is still going on.

Digestion of the stomach after death is especially interesting, because it exhibits to us in a very striking manner the self-protective power possessed by living tissues. While the food we take into the stomach is rapidly dissolved by the mere chemical action of the fluid which is there secreted, the coats of the stomach itself, which in composition are nearly the same as the food which is thus dissolved, suffer no damage. The chemical action of the gastric juice, as regards the stomach itself, and no doubt the chemical action of various articles of food as well, is counteracted by the forces which the nutrition of the organ developes. We have, indeed, the protective influence of these forces always presented to us in the resistance which the tissues of living bodies offer to the chemical affinity of the matter by which they are surrounded. Even air and moisture, which are so necessary to the continuance of life, destroy by their chemical action, and resolve into simpler chemical combinations, all the tissues of both animals and plants when life is extinct. But the instance we have been considering is perhaps more likely to fix attention, from the circumstance that the de-

structive agent is formed by the very tissues which it subsequently serves to destroy. We see an analogous instance in plants. The leaves of a living plant, under the influence of light, are continually evolving oxygen; yet they yield readily to the chemical action of the oxygen of the air when the vital principle is extinct.

The protective influence of the forces developed in the processes of nutrition has not been sufficiently considered in pathology. It is through the resistance which they offer to destructive chemical changes that the tissues of living bodies remain unhurt amidst the many causes of disturbance to which they are ever exposed. This vital resistance, if we may so term it, exists in different degrees in different persons. Men of feeble constitution have frequently recurring ailments, the effect of external agencies, which they have not strength enough to resist; others, by nature more robust, exposed to these same agencies, pass through life without ever suffering sickness.

The vital resistance varies in intensity at different periods of life, and becomes very feeble in old age, when the tissues suffer damage, and when the current even of life may be stopped by slight disturbing influences. The way to prolong life in old age is carefully to protect the body from cold and from all other avoidable causes of disturbance: above all things to abstain from lowering remedies in the treatment of the ailments that are incident to it.

But, at any period of life, the vital resistance varies in degree according to the circumstances in which the person is placed. It requires for its support the proper nutrition of the tissues. Whatever promotes this—as pure air, good food, the natural stimulus of the nerves, the healthy play of the different organs—serves to maintain and increase it. Whatever lowers the nutrition of any part, renders that part more liable to disease from chemical disturbing influences from without. So it is with the whole body. Whatever exhausts the body—as insufficient food, prolonged cold, excessive bodily fatigue, the depressing passions—leaves it without its proper protection. Its tissues suffer damage from external agencies which in other conditions of the body would have been without injurious effect.

Disease always comes in the train of exhausting or depressing influences of whatever kind. Fever attacks the poor in preference to the rich,—the new-comers to towns,—those of our medical students who are exhausted by work. Erysipelas infects those who

are weakened by other diseases. Consumption is especially frequent among the inmates of prisons. It has long been a popular notion, and is probably a true one, that the dread of cholera predisposes to it. After devastating wars, and in seasons of scarcity, when a whole population is depressed, pestilence invariably comes in the form of infectious fever or malarious disease. This has long been known to the historian and the statesman, as the result of experience. The physician looks deeper, and sees in it the effect of the diminished vital resistance which all exhausting or depressing influences occasion.

LECTURE II.

Softening of the coats of the stomach from the action of the gastric juice after death—Different circumstances under which it occurs—Inferences to be drawn from them.

SOFTENING of the stomach having the same characters as that which was found by Hunter in the bodies of persons who had been killed by accident in the midst of health and soon after a full meal, —that is, while digestion was actively going on—occurs also, and not unfrequently, in other and very different circumstances.

Cruveilhier has distinguished two kinds of softening of the stomach, both occurring principally in its big end, and has called them the *pulpy* softening and the *gelatinous* softening, from the appearance respectively presented by the softened tissues. The pulpy softening he supposes to occur after death, from the action of the gastric juice; the gelatinous softening, during life, from a peculiar morbid process. Rokitanski distinguishes three varieties of softening in this portion of the stomach, according to the colour of the softened tissues; and two of these he supposes to occur during life, as the effect of disease.

An attentive examination of these so-called varieties leaves no doubt in my mind that they are all produced after death, and by the same agent,—namely, the gastric juice; and that the differences of transparency and colour in the softened tissues, to which so much importance has been attached, result mainly from variations in the quantity of blood in these tissues at the time of death.

In illustration of this, I may call your attention to a stomach on

the table, which I obtained, two days ago, from a man who died of phthisis in King's College Hospital. The stomach was much congested at the time of death, and towards its pyloric portion the edges of the folds, which are the only parts where the mucous membrane is softened, appear as brown lines or bands. The change is exactly like that represented in this plate of Cruveilhier, which he gives as an illustration of the *gelatiniform* softening, except in the darker colour and in the want of transparency of the softened tissues; which are perfectly explained by the greater quantity of blood which the tissues contained at the time of death.

The essential characters of the change are:—

1st. A softening of the mucous membrane, usually over a considerable space in the great end of the stomach, and *along the edges of the folds* extending from this towards the pyloric end; parts which, for reasons I have already assigned, are most exposed to the action of the dissolving agent.

2nd. A blackening of the blood in the tissues so acted upon, giving various shades of brown to the softened tissues when much blood was contained in them at the time of death.

A third character of the change is, that the softened or digested tissues have an acid reaction; and that they putrefy less readily than other parts, in consequence of the antiseptic properties of the gastric juice.

These characters will serve in most cases to distinguish the digestion of the stomach that occurs after death, even in its slighter degrees, from every other change. If the coats of the stomach at the time of death were empty of blood, they are rendered, in the process of softening, more or less transparent or *gelatiniform*, as all albuminous tissues are when acted upon by the gastric juice or by acetic acid: if, on the contrary, the softened tissues contained much blood or fat, they became brown and opaque or paste-like.

As the digestion proceeds, the mucous membrane is rendered thinner and softer, until it resembles a thin layer of mucus or paste. The other coats of the stomach are next dissolved and removed, in succession, from within outwards, until a ragged aperture is made through which the contents of the stomach escape into the peritoneal sac. The process of digestion may still go on, so that the side of the spleen contiguous to the stomach may be dissolved, or the diaphragm at that part may be eaten through, and the contents of the stomach pass into the cavity of the chest.

It occasionally happens, as I have before remarked, that some

liquid from the stomach regurgitates, after death, through the cardiac orifice, and causes similar changes in the lower end of the œsophagus.

The conditions necessary for this *post mortem* digestion of the coats of the stomach are, first, that the stomach at the time of death should contain some gastric juice, or at least some muriatic or lactic acid; and second, that it should be kept for some hours after death at the temperature required for artificial digestion.

The first condition is very generally fulfilled in persons who are killed by accident, in the midst of health, and soon after a meal; and up to this time it has been commonly supposed that digestion of the stomach after death occurs in a high degree only under such circumstances.

It has, indeed, been generally taught that gastric juice is only secreted while food is in the stomach, and that it only exists in the stomach for a few hours after a meal,—and this is, no doubt, true for persons in health. Dr. Beaumont, during the long time that he made St. Martin the subject of experiment, invariably found that when the stomach was empty of food, the fluid which moistened its surface was not acid and had no peculiar solvent power.

But in certain diseases gastric juice is secreted when the stomach is empty, and exists in the stomach unmixed with food and long after food has been taken.

Again, in certain catarrhal states of the stomach, the lactic fermentation is apt to occur in the saccharine principles of the food in the stomach, and the result is, the generation of a large quantity of lactic acid, which forms with the mucous membrane of the stomach a digesting mixture.

In persons who die of the diseases and disorders in question, digestion of the stomach is often found in as high a degree as in persons killed by accident in the midst of health and soon after a meal: and not unfrequently the softening of the stomach may be predicted with tolerable certainty by a peculiar train of symptoms which result, I imagine, from the presence of free gastric juice, or of a digesting acid, in the otherwise empty stomach.

This occasionally happens in cases of simple ulcer of the stomach. On the table are two preparations exhibiting this disease in conjunction with entire destruction of the mucous membrane in the great end of the stomach, doubtless produced by the gastric juice. One of these preparations has been long in the Museum of King's College; the other is that of a stomach which I obtained in the

month of January, in very cold weather, from a man who died under my care in King's College Hospital, from perforation of the stomach, caused by the ulcer.

In simple ulcer of the stomach, pain at the epigastrium is sometimes felt when the stomach is empty of food; and, together with thirst and an impaired appetite, there are frequently sour eructations and occasional vomiting of a sour fluid. These symptoms seem to depend mainly on the presence of gastric juice, or its acid, in the otherwise empty stomach. It is easy to conceive that the flow of the juice may be excited in the empty stomach by the irritation of the ulcer or its secretions, just as it was in the experiments of Spallanzani by the mechanical irritation of pebbles or of bits of sponge or glass.

Digestion of the stomach in a high degree is found much more frequently in persons—and especially in women—who die of phthisis. On the table are two preparations in which this is well exhibited:—the mucous membrane in the great end of the stomach is completely destroyed, and the branching vessels in the submucous cellular tissue are exposed, and are very conspicuous, from the blackening of the blood they contain. These stomachs were obtained from men who died of phthisis in King's College Hospital; one of them last summer, the other about two months ago. It now and then happens that in persons who die of this disease, the muscular and serous coats in the great end of the stomach are found dissolved, as well as the mucous coat: and the stomach, when removed, exhibits an aperture on its great end, with ragged flocculent edges, as when death happens suddenly after a full meal; and, as in these latter cases, the absence of any marks of inflammation of the peritoneum or of the coats of the stomach, as well as the peculiar characters of the change itself, show clearly that the softening takes place after death, from the action of the gastric juice.

This softening of the stomach has been well described by M. Louis, who was not, however, aware of its real cause. In his elaborate work on phthisis, he states that he observed it in about one-fifth of the subjects he examined, who had died of this disease.

The individuals in whom it is found have generally had for some weeks, and often for several months before death, much disorder of the stomach: pain and tenderness at the epigastrium, loss of appetite, thirst, frequent vomiting (the matters vomited being slightly acid,) or frequent nausea.

This gastric disorder, which is extremely common in the ad-

vanced stages of phthisis, exhausts the strength, and sometimes attracts more of the patient's attention than the primary disease of the lung. The frequent occurrence of the peculiar softening of the coats of the stomach caused by the gastric juice after death, in the persons in whom it has existed, shows that this disorder is associated with increased secretion of gastric juice, or with the presence of gastric juice, or of a digesting acid, in the otherwise empty stomach. It is not improbable that in these cases, the flow of gastric juice in the empty stomach is excited by irritation of the lung, just as it was excited by Spallanzani, in his own person, by voluntary irritation of the fauces.

3rd. Digestion of the stomach after death frequently takes place, also, in persons who die of inflammatory diseases of the brain. These diseases give rise to the same kind of secondary gastric disorder as tuberculous disease of the lung—viz., frequent vomiting or nausea; together with pain at the stomach, thirst, and loss of appetite, unless the latter symptoms are masked by delirium or blunted sensation. The frequent occurrence of softening of the stomach after death in inflammatory diseases of the brain shows, as in cases of phthisis, that this gastric disorder is associated with increased secretion of gastric juice, or with the presence of gastric juice, or its acid, in the otherwise empty stomach.

The cases are strictly analogous in this respect to the instance which I related in my last lecture, in which the highest degree of digestion of the stomach and diaphragm was found in a man who died from fracture of the skull after an unusually prolonged fast.

4th. Softening of the stomach of the same kind is also often met with in persons who die of typhoid fever, especially, I believe, where death has been preceded by delirium or other serious disorder of the functions of the brain.

In some instances in which this happens there has been pain and soreness of the stomach, and vomiting, for some days before death; but generally the gastric disorder is masked by the delirium or the blunted state of sensation which usually exists in severe forms of fever.

When softening of the stomach occurs in persons who have died of fever, the softened tissues have generally a rust-colour, or brownish tint, from the circumstance of the blood remaining fluid and gravitating to the lowermost parts of the stomach, where the softening takes place.

5th. The same change is occasionally met with in persons who

die of cancer of the uterus, or of peritonitis, or of other diseases of the abdominal viscera, which lead to secondary functional disorder of the stomach. Where it occurs in conjunction with chronic diseases, as phthisis or cancer of the uterus, which do not cause delirium or coma, it has generally been preceded for some time before death by the peculiar gastric disorder which I have described. When it occurs in conjunction with inflammatory disease of the brain or fever, which destroy or pervert sensation and which kill quickly the symptoms of gastric disorder are, of course, less marked, and are often altogether absent.

In any case, the degree of the softening bears no necessary relation to the severity or duration of the gastric disorder. The gastric disorder may have existed for months, but the stomach may chance to be empty at the time of death, and no softening of its coats occurs. And, on the other hand, where there has been no gastric disorder, or only a slight degree of it, a considerable quantity of gastric juice may be poured out just before death, and the highest degree of softening take place.

These facts have been noticed by Louis, Cruveilheir, and others, whose attention has been directed to this subject; and, as they supposed the softening to be the result of disease and to occur during life, they could only explain them by supposing that at times this disease runs a very rapid course, or that it is *latent:* in other words, that it gives rise to no appreciable symptoms.

All these difficulties are removed by the explanation which I have offered: namely, that the softening occurs, in all cases, after death; and that the degree of it depends, if the conditions of temperature, &c., be alike, on the quantity of the solvent juice in the stomach at the time of death, and not at all on the duration or extent of the gastric disorder.

The same kind of gastric disorder not unfrequently occurs, especially in nervous women, from disordered menstruation, the irritation of gall-stones, or some other cause of disturbance, and after continuing in a severe form for weeks, or even for months, subsides, on the removal of its exciting cause or an improvement of the general health, and the power of the stomach is perfectly restored. No weakness of digestion or other symptom remains to show that the organ has been damaged in its structure.

But it is in infants who die from the age of three or four months to two years that softening of the stomach in a high degree occurs most frequently. In them different portions of the intestines are frequently found softened as well as the stomach; and the

softened tissues, from the state of anæmia in which infants usually die, are generally semitransparent, or *gelatiniform*.

The change is found very commonly in infants who die from hydrocephalus or phthisis, and occasionally, unconnected with any structural disease, in infants who die of exhaustion consequent on the eruptive fevers or on improper diet after weaning.

The children in whom it takes place have generally had for some time before death severe disorder of the stomach of the same kind as occurs in adults: frequent vomiting, loss of appetite, great thirst, and crying, as if from pain; and with these symptoms there is often diarrhœa, the discharges from the bowels being *green*, like spinach, from the presence, I imagine, of bile acted on by muriatic acid which has passed down from the stomach, or of lactic acid which has passed down from the stomach or been formed in the bowel, and has not been neutralized by the various secretions of the intestinal canal.

In infants the softening of the stomach is found unconnected with organic disease of other organs much more frequently than in adults, because in them the functional gastric disorder, which may be excited by teething or other causes of disturbance, rapidly exhausts the strength, causing a state of collapse, and thus proving fatal of itself.

In infants, the softening is usually more extensive than in adults, and in higher degree; more frequently leading to perforation of the stomach and to softening or corrosion of contiguous organs. As in adults, however, the degree of softening bears no necessary relation to the severity or duration of the gastric symptoms; and this circumstance, together with the absence of any marks of inflammation in the peritoneum, even when the diaphragm, as well as the stomach, has been dissolved quite through, shows that the changes have taken place after death.

This softening of the stomach is usually found, then, in persons who die of disease in some other organ, *and of those diseases especially which have long been known to lead to secondary functional disorder of the stomach.* Now this peculiar softening of the coats of the stomach is, in any case, a clear proof that there was active gastric juice, or its acid, in the stomach at the time of death. Its frequent occurrence, therefore, in persons who die of the diseases I have mentioned, shows us that the functional disorder of the stomach, so common in those diseases, is associated with increased secretion of gastric juice, or its acid; or with secretion of the gastric juice, or its acid, when there is no food in the stomach; or

with undue retention of it in the stomach; so that at the time of death active gastric juice is contained in the stomach, which subsequently dissolves or digests its coats.

The question then arises—How is this functional disorder brought about in these several diseases, and what is its real nature?

When disease of any one organ causes secondary disease of another and distant organ, it must be either through the circulating fluids, or through the nervous system. It is only by the circulating fluids, or through the nerves, that disease of an organ can cause secondary disorder of a different organ remote from it.

But, in the cases in question, this secondary disorder of the stomach can hardly arise through the blood. Tubercular disease of the lung, continued fevers, inflammatory diseases of the brain, cancer of the uterus, and mere functional disorder of this organ, lead to no common change in the blood by which this peculiar functional disorder of the stomach can be explained.

We are driven, then, to the inference, that the secondary disorder of the stomach in these diseases is produced through the intervention of the nervous system. And this inference is confirmed by the fact, that in phthisis the softening of the coats of the stomach after death, like the functional disorder that usually precedes it, is more common in women than in men; and that when it results from inflammatory disease of the brain it is much more common in young children than in grown-up persons. For the same primary disease, whether it be of the brain or of the lung, the change is most common in those persons who, by their sex and age, are most liable to sympathetic disorders.

Considering, then, this functional disorder as a sympathetic disorder excited through the nervous system, the further question arises—What is its real nature? Does this sympathetic disorder affect the secreting apparatus of the stomach, or merely its muscular coat?

In my last lecture I mentioned the circumstances which led me to infer that the outpouring of the gastric juice, which has been supposed to result from direct irritation of the stomach alone, might also be excited, through reflex nervous influence, by irritation of other parts; that as the flow of urine may be increased by emotion as well as by direct irritation of the kidney through the blood; or as the secretion of tears may be excited by irritation of the nostril or the mouth, or by emotion, as well as by irritation of the surface of the eyeball: so might the outpouring of the gastric

juice be excited by irritation of the fauces, and, therefore, probably of the lung, or by irritation of the brain, as well as by mechanical or other irritation of the inner surface of the stomach itself.

The circumstances which I have brought under your notice today confirm this inference, and afford additional grounds for supposing that in many of the cases we have been considering it is to the secretion of gastric juice excited in this way in an empty stomach that the symptoms referable to the stomach, and the digestion of its coats after death, are mainly owing; that the secondary disorder of the stomach which occurs in inflammatory diseases of the brain, in phthisis, and various diseases of the abdominal viscera, affects the secreting apparatus of the stomach, as well as its muscular coat.

The secretion of gastric juice when the stomach is empty of food, is, of course, a waste of digestive power, and necessarily leaves the stomach more or less exhausted for a time. If, after the wasted juice has passed away, more food be taken than the exhausted stomach can readily dissolve, it frets the mucous membrane, and may cause it to secrete an unhealthy mucus, which, acting as a ferment, may lead to the frequent and abundant generation of lactic acid from the saccharine elements of the food.

In some of the cases to which I have alluded, the softening of the coats of the stomach may, however, be accounted for in another way; namely, by supposing that an impediment existed to the free action of the muscular fibres, so that the stomach could not be completely emptied, and that the acid thus remaining in the stomach after digestion was over, dissolved its coats after death.

Softening of the stomach, which may be satisfactorily accounted for in this way, is now and then found in conjunction with cancer of the pylorus, and in some cases of simple ulcer of the stomach, when the ulcer is near the pylorus, or when it is of long standing and partially cicatrized, so that it has altered the shape of the stomach and prevents the proper action of the muscular fibres.

The explanation applies also to those cases of phthisis in which the stomach is found much enlarged as well as softened. It was particularly remarked by M. Louis, and has been long known, that the stomach often becomes much enlarged in the course of phthisis, being not unfrequently found after death three or four times its usual size. No satisfactory explanation of this enlargement of the stomach has, that I am aware of, been yet given. M. Louis ascribes it to the frequent cough; but, if it were so produced, it

would be observed in conjunction with mere chronic catarrh as frequently as with phthisis. The real cause of it is, I believe, enlargement of the liver from fatty degeneration, which always exists in those cases of phthisis in which the stomach is found much enlarged after death. The large liver compresses the pyloric division of the stomach, and prevents the stomach from being emptied through the pylorus by the wasted and weakened muscular fibres. When this happens, some of the acid products of digestion must remain in the stomach, and may be the cause of the softening of its coats found after death.

In many cases of phthisis, and in most of the cases of other diseases in which the stomach is found softened, the change cannot be thus explained, and can only be accounted for by the supposition I have before advanced.

I have hitherto described the most common form of softening by the gastric juice; namely, where the great end of the stomach and the lower and back part of the œsophagus—parts on which the gastric juice usually lodges after death—are the parts softened. But, occasionally, softening of the same kind occurs in other situations. Cruveilhier remarked that the *gelatiniform* softening is sometimes found on the anterior wall of the stomach, when the stomach is empty, and when there is no softening on the posterior wall or in the great end, where the softening or digestion after death usually takes place; and that in some instances the same kind of softening occurs also in the intestines; and he considers these facts conclusive evidence that the softening could not in such cases be the effect of the gastric juice, and that it must have resulted from disease, and during life. He says—"The gelatiniform softening is generally met with in the splenic end of the stomach; but it occurs also in its anterior wall, and in various parts of the small and of the large intestine, and in the lower end of the œsophagus. The softening always proceeds from within outwards, and in the intestines, as in the stomach, may lead to perforation. The parts thus transformed are colourless, transparent, completely deprived of vessels, and of a sour smell, without any marks of inflammation, and without the odour of gangrene. The softened parts, indeed, undergo putrefaction less readily than others." This kind of softening, he adds, occurs occasionally in adults, but it is much more common in infants.

Soon after the publication of Hunter's paper, by which the attention of the profession was first called to the digestion of the sto-

mach after death, instances of this kind were noticed; and in the sixth vol. of the "Edinburgh Medical and Surgical Journal," there is a paper by Mr. Adam Burns, containing observations exactly like those of Cruveilhier. Burns met with three cases in which the fore part of the stomach was dissolved; and four cases (apparently including these three) in which every part of the alimentary canal, from the cardiac orifice of the stomach to the beginning of the rectum, was dissolved into a pulpy, glutinous mass, transparent, and bearing some resemblance to thick starch. Not a single point of either the stomach or intestinal tube but was so much acted upon, that it tore whenever it was even gently touched. The other viscera presented no peculiar changes. The subjects were young children, fat, and free from putrefaction. In all of them, the abdomen, when opened, emitted a sour smell. Burns did not know the history of these persons, and could tell nothing of their condition during life.

As in instances like those I have just cited, the softening occurs in parts with which the gastric juice does not generally come into contact, the question naturally arises—may not the softening in such instances have been brought about in some other way? It is important to bear in mind that ordinary putrefaction does not produce these effects. The changes which putrefaction causes in the firmness and texture of the mucous membrane of the stomach occur very slowly. For several days after death, when most of the viscera are softened by putrefaction, the mucous membrane of the stomach often retains almost the firmness which it had at the time of death. Gas forms in the sub-mucous cellular tissue, causing an emphysematous condition of the coats of the stomach; the blood decomposes, and filters through the vessels, and stains its different coats; the stomach becomes further discoloured by the gases that permeate its tissues; but the mucous membrane retains its firmness, sometimes, as was observed by Andral, for eight or ten days after death. From this the inference may be drawn that unnatural softness of the mucous membrane of the stomach cannot be ascribed to ordinary putrefaction unless many days have elapsed since death, or unless putrefaction has far advanced in other parts of the body.

But, setting putrefaction aside, might not the softening of the stomach and intestines have occurred during life, from defective nutrition, or some other morbid process? The stomach and intestines, it is especially stated by both Cruveilhier and Burns, exhibited no traces of inflammation; and the same remark has been

made by other pathologists who have described similar appearances in these organs; but we not unfrequently find softening of other tissues, occurring from some obscure fault of nutrition, without any process to which the term *inflammation* can be rightly applied. This sometimes happens, in organs that are much exercised, from mere defective nourishment. The more an organ is exercised, the greater is the waste of its constituents, and the sooner, therefore, it suffers, when, from defective supply of food or from any fault in the assimilating processes, the repair of its waste is prevented.

The cornea, from being of delicate texture and much exposed, suffers from defective nourishment, and becomes ulcerated, when firmer and more protected and more vascular tissues, into the composition of which nearly the same elements enter, present no such marks of destruction. The muscles of the heart are in continual action, and in low fevers (in which the fibrine of the blood becomes much diminished, and the nutrition of the muscles is prevented) they undergo a softening that does not occur in the voluntary muscles, which, from the commencement of these fevers, are in comparative repose. But in the secreting glands, which have many points in common with the mucous membranes, as regards both structure and function, a similar softening is now and then met with, without any trace of inflammation, the result, seemingly, of some obscure defect of nutrition.

A change of this kind is occasionally met with in the liver, in those cases of jaundice that prove fatal speedily from disorder of the functions of the brain. All the tissues of the liver, in certain parts of the organ, are found softened, or disorganized; and in these parts, on microscopic examination, none of the hepatic cells, which serve to secrete the bile, can be seen.

The question, then, very naturally arises,—Might not the softening of the stomach and intestines in the cases to which I have referred, have resulted from some obscure fault of nutrition? A consideration of the particulars of these cases will, I think, show conclusively that it did not so originate, but that, as in the ordinary cases of stomach digestion, the change occurred after death, and was the effect of a chemical solvent.

Cruveilhier has given the particulars of a case in which he found the fore part of the stomach softened, and a drawing, representing the appearance of the stomach in question. The person in whom this occurred was a man-servant, twenty-two years of age, who died of fever, in the latter stages of which there was severe disorder of

the brain. The stomach was found empty, and was only softened in this spot on its anterior surface. The mucous and muscular coats were here destroyed and removed, so that the perforation was only prevented by the peritoneum, which was spread as a thin gauze over the part.

But there is another circumstance noticed by Cruveilhier, which to my mind is quite conclusive that the softening resulted from the gastric juice after death. In the lower and back part of the œsophagus there were two perforations leading into the left pleural sac, just as are found occasionally in conjunction with softening of the great end of the stomach in persons killed by accident, in the midst of health, and soon after a meal; and, as happens in these latter cases, the edges of the perforations were soft and ragged, and the bloodvessels surrounding them *were of a jet black.* Cruveilhier notices, moreover, that at a spot corresponding to these apertures, the pleura covering the lung *had also undergone the gelatiniform softening, and that the tissue of the lung was laid bare;* and with all this, he expressly states, there were no marks of inflammation, either in the pleura or in the lung.

But if any doubt still remains of the nature of these changes, it will be removed by a case, which I will next cite, recorded by Adam Burns in the paper to which I have already referred.

The following are the particulars of the case, as given by Burns:—

"About ten months ago, I had occasion, two days after death, to open the body of a very emaciated and anasarcous young girl, who had died from scrofulous enlargement of the mesenteric glands. On raising the coverings of the abdomen, the stomach, which was empty, presented itself to view, with its front dissolved. The aperture was of an oblong shape, about two inches in its long diameter, and an inch in its short, with tender, flocculent, and pulpy edges. This I demonstrated to the pupils attending my class; and I especially called their attention to the fact, that the liver, which was in contact with the hole, had no impression made on it. Having proceeded thus far, I placed all the parts as they had been, stitched up the abdomen, and laid the body aside in a cold situation for two days. Then I opened it again, in presence of the same gentlemen, and we found that now the liver, where it lay over the dissolved part of the stomach, was pulpy; its peritoneal coat was completely dissolved, and its substance was tender to a considerable depth. At this time the other parts of the liver were equally solid as before; and as yet every part of the subject was free from putrefaction.

The posterior face of the stomach, opposite to the hole, was dissolved, all except the peritoneal coat; at least, the internal coats were rendered pulpy and glutinous." "The dissolved part," he goes on to observe, "was seated at the fore part of the stomach, about an inch distant from the pylorus, and midway between the smaller and greater curvatures of this viscus, at a part of the stomach with which the gastric juice could not have come into contact, as the body had constantly been in the supine posture."

Now, it will naturally be asked,—If the softening of the stomach in these cases was the effect of the gastric juice acting after death, how did it happen that the fore part of the stomach was dissolved, while the hinder and lowermost parts, where fluids in the stomach tend to collect, were not dissolved?

The following is, I have little doubt, the right explanation of the fact. In the case related by Cruveilhier, the stomach is stated to have been empty; that is, its surface was moistened merely by the gastric juice. Now the man died of fever, and, as happens in the severe forms of this disease, the blood, we may infer, was unusually fluid after death, and gravitated to the lowermost parts of the stomach, and the transudation of the alkaline serum of the blood through the coats of the vessels in these parts neutralized the acid of the small quantity of gastric juice contained therein, and destroyed its solvent power.

In Burns' case, the fact that the stomach was softened in its fore part only, may be explained in the same way. The stomach, here also, was empty, and the girl was dropsical. The alkaline dropsical fluid, transuding through the coats of the stomach at its hinder or lowermost part, neutralized the acid of the small quantity of gastric juice that moistened its coats, and prevented any digestive action from taking place there.

It may be predicted with tolerable safety that it will be only in such cases, and where the stomach is empty, that softening of the upper or fore part will occur, without there being at the same time softening of the lower and hinder parts.

If it be established by the circumstances I have mentioned that the softening of the stomach in these cases was the effect of the gastric juice after death, the presumption is very strong that the so-called gelatiniform softening of the intestines, which is met with in the same class of cases as the softening of the stomach, and very generally (as seems to have happened in three of the cases related by Burns) in the same persons:—the presumption, I say, is very

strong that the softening of the intestines is of the same nature, and produced by the same agent.

But, without reference to the stomach or to the circumstances in which the softening occurs, and considering merely the characters of the change in the intestines, we are led to the same conclusion.

The change, like that produced by the gastric juice, affects the different coats of the bowel in succession, from within outwards, leading at length to perforation.

The decomposition, like that in digestion, is unattended by evolution of gas.

The parts softened, when they did not contain much blood at the time of death, have a semi-transparency, or a gelatinous appearance, like albuminous tissues in process of softening by the gastric juice.

Again, from the observations of Burns, we may infer that the change in question, like digestion of the stomach after death, is most common in summer. Burns, indeed, tells us that he never met with it except in the summer months.

Digestion after death requires the presence of a free acid, and, as digestion goes on, the acidity of the gastric fluids increases. Now, both Cruveilhier and Burns particularly remarked, and their observations appear to be quite independent, that the softened intestines in the cases in question had a sour smell.

Another very important property of the gastric juice is, that it prevents putrefaction. Now it is stated by Cruveilhier, and the same may be inferred from the remarks of Burns, that the softened parts had no odour of gangrene. Cruveilhier expressly says, indeed, that they undergo putrefaction less readily than others.

All the circumstances I have mentioned—the circumstances, namely, that the softening of the coats of the intestines occurs in the same class of cases, and sometimes in the same person, as softening of the stomach; that it occurs especially in summer; that it involves the different coats of the bowels in succession, from within outwards; that it is unattended by the evolution of gas; that the softened tissues have a semi-transparency, and a sour smell; and that they exhibit no marks of inflammation, and are free from any odour of gangrene:—all these circumstances leave, I think, no doubt that the change in question is a digestion of the tissues, and that it occurs after death.

The softening of the intestines is most commonly found in infants who have died of hydrocephalus, or of tuberculous disease of

the lung, or with functional disorder of the brain; and in whom, together with the peculiar gastric disorder that so often exists in the cases in which softening of the stomach is found, there has been severe diarrhœa, with green, spinach-like stools: the green colour being the effect of uncombined acid on the bile.

Softening of the intestines, like softening of the stomach, is also found occasionally in grown-up persons who have died of phthisis, or of typhoid fever; especially where diarrhœa has existed, with the peculiar gastric symptoms to which I have so often referred.

There can be little doubt that in the cases in which this happens the gastric juice passes, in its active state, from the stomach into the intestines; and that not meeting there with alkali enough to neutralize its acid, and thus destroy its solvent powers, it dissolves or digests the coats of the intestine after death.

The result, then, at which I arrive is, that the softening, with thinness, of the coats of the alimentary canal, described by Louis, the pasty or pulpy and the gelatiniform softening of Cruveilhier, and the other varieties, described by other authors, distinguished by the colour of the softened tissues, are essentially the same change; and that this change, whether it exist in the lower end of the œsophagus, or in the great end of the stomach, or in the fore part of the stomach only, or in any part of the small or the large intestine, is the result of *digestion* after death,* like the softening of the great end of the stomach, remarked by Hunter, that occurs after sudden and violent death, in the midst of health, and soon after a meal.

I have occupied much of your time in considering the change, because I consider the subject is one of great importance. It is obviously important with reference to medico-legal inquiries; and it is important, also, with reference to the attainment of a right knowledge of the pathology of the digestive organs. Every one who has studied the diseases of these organs by means of morbid anatomy must have had his mind perplexed, as mine has often been, and his progress stayed, by the continually recurring question, What do these striking changes mean?

But the subject is important, too, with immediate reference to practice, because the study of it leads us to a more intimate knowledge of a peculiar form of indigestion, which is of frequent occur-

* The intestines are probably sometimes digested by their own proper juices, which, although alkaline, have been lately found to possess, like the gastric juice, a digestive power over albuminous tissues.

rence. In the class of cases, indeed, in which this form of softening of the stomach and intestines is found after death, there generally exists for some time previous to death a peculiar form of indigestion, attended with various distressing symptoms referable to the stomach and bowels,—the result mainly of the presence of free, uncombined digestive acid in them; and the efficacy of liquor potassæ and other alkalies in relieving this gastric disorder, and the like efficacy of chalk mixture (which furnishes an insoluble antacid which is not absorbed in the stomach, but passes down into the intestines,) in relieving the diarrhœa and the griping pain that attends it;—the efficacy of these medicines results from their neutralizing this acid, and thus preventing the gastric juice, which loses its solvent power when thus neutralized, from exerting any chemical action on the tissues or calling for the expenditure of their vital force of resistance.

LECTURE III.

The organic diseases and functional disorders of the stomach—Arrangement of the subject—Congestion of the stomach resulting from an impediment to the course of the blood through the liver or the chest—Congestion resulting from other causes.

In passing under review the disorders of the stomach, I shall speak first of those which depend on organic disease, or on some visible or palpable change in the coats of the stomach; and afterwards of those, the so-called functional disorders, which result from derangement of the general health or from disease originating in some other part of the body.

Of organic changes in the coats of the stomach, one of the simplest is *congestion*—that is, a plethora of the bloodvessels—which is a very common morbid condition, and a very important one with reference to the medical treatment of various diseases.

Congestion of the stomach, as of the other organs which have an active function, may result from very different conditions. A congestion, or over-fulness of the bloodvessels of the stomach, may obviously result from any mechanical impediment to the return of blood from the stomach to the heart. The congestion thus arising is of the simplest kind—the kind most intelligible to us—and we may, therefore, fitly consider its effects first.

A striking instance, showing some of these effects, is recorded in

an admirable paper on this subject by Dr. Yellowly, in the fourth volume of the "Medico-Chirurgical Transactions."

Philip Nicholson, a man about thirty years of age, was hanged on Penenden Heath, near Maidstone, on the 23rd of August, 1813. He was greatly convulsed while hanging, and died unusually hard. The body was opened the following day at three o'clock in presence of Dr. Yellowly, who thus describes the state of the stomach:

"The whole of the abdominal viscera were deeply congested with dark-coloured blood.

"The external vessels of the stomach were very turgid, and its inner surface was everywhere coated by dark-coloured, clotted blood. This adhered pretty firmly to the mucous membrane, but came off, though with some difficulty, when the stomach was put into water. Much of it, however, continued to hang about the folds in the great end, though the other parts were freed. Where the blood was washed off, the whole surface of the mucous coat was red."

In this instance, great congestion of the stomach was rapidly brought on by strangulation; and its most striking effects, as seen in the dead body, were uniform redness of the mucous membrane and the extravasation of clotted blood upon it. This clotted blood coated the whole inner surface of the stomach, and adhered firmly to it, and had evidently escaped, not at one spot from a large ruptured vessel, but by exhalation from every part of the free surface of the membrane.

A near approach to the sudden strangulation which the hangman inflicts is presented to us in severe epileptic fits, which are not unfrequently followed by vomiting of blood and by the discharge of blackened and altered blood from the bowel. To take one instance among several such which my hospital case-books contain:—On the 18th of November 1854, Joseph Parish, a well-nourished man, thirty-six years of age, was admitted into the hospital with partial paralysis of the left arm and leg and of the right side of the face, which occurred during a severe epileptic fit a fortnight before. His appetite and digestion were good, and there was no symptom to indicate that anything was amiss with the stomach. On the 30th of November, about eight in the evening, he was seized with another epileptic paroxysm, in which rigid contraction of the muscles of one side alternated with terrible convulsions, "as if," to use the words of the physician's assistant, "powerful electric currents were being passed through the different portions of the frame." During the convulsions, the face and neck became highly congested, and every

now and then a good deal of frothy saliva was forced from the mouth. The convulsions were at times succeeded by a state of profound stertor, which continued three or four minutes, when the convulsions would recur again.

The epileptic paroxysm lasted nearly four hours, when the convulsions entirely ceased, and soon after this, a faint gleam of intelligence beginning to dawn, he was seized with vomiting, and threw up about half a pint of dark-brown, almost black, coffee-ground-looking matter, which owed its colour, as the microscope showed, to the presence of altered blood. The following night, when the bowels moved for the first time after the fit, the discharges from them were reported to be black, like pitch. The vomiting did not recur.

The day after the fit he was very much exhausted, but quite conscious, and answered pretty readily questions addressed to him. He expressed himself as not desiring food, but feeling very thirsty. He was placed on milk diet, and desired nothing more till the 5th of December, five days after the occurrence of the fit, when the appetite for meat and the power to digest it returned. On the 8th of December, and for some days afterwards, the appetite was ravenous and the meat diet of the hospital appeared to be digested with ease.

On the 14th of January, he was again seized with horrible epileptic convulsions, during which he vomited blackened and altered blood, as on the 30th of November. The convulsions lasted many hours, and were succeeded by a state of coma, in which he died at 7 A. M., on the 15th. When the body was opened, there were found scattered over the surface of the brain a great number of small cysts containing the cysticercus cellulosa, which were doubtless the cause of the epileptic convulsions. The stomach contained from two to three ounces of a dark grumous fluid like that vomited during the fits. On washing it, a dark ecchymosed patch was found near the lesser curvature, but no sign of ulceration was anywhere to be detected. In this instance the blood was vomited in minute shreds or flakes, because it oozed drop by drop, and coagulated as it oozed, from the open surface of the mucous membrane. The appetite and the power of digestion quickly returned, after the vomiting of blood on the 30th of November, because no great injury was done to the membrane.

Congestion of the stomach of the same kind, but more gradual in its occurrence, and generally less in degree, always exists in

persons with the "hob-nail," or gin-drinker's liver. In this disease, the current of blood through the liver is impeded, and the stomach and intestines, which send all their blood to the portal vein, are consequently kept in a state of congestion. This frequently leads to an oozing of blood from the mucous membrane, and it now and then happens that the hemorrhage is abundant, so that a great quantity of blood is brought up by vomiting. I have met with several instances of cirrhosis, in which death was caused, or at least was very much hastened, by hemorrhage from this source, and in which the sound state of the stomach after death showed that the blood had exhaled from the unbroken surface of the mucous membrane. An abundant hemorrhage is, however, comparatively rare. The congestion is slowly produced, and the minute vessels most probably grow gradually stronger, so as to bear the additional stress upon them. Far more commonly the oozing of blood is slight in degree, but may continue for many days, or even weeks. During this time the patient has constant pain at the epigastrium, and may vomit daily a small quantity of blackened blood, which is generally mixed with mucus, or is in very small distinct coagula, that consist of the colouring matter of the blood, and also of its albumen, which is coagulated as it exudes from the vessels by the acid secretions of the stomach. Occasionally, the stools also are stained with blood, which may have come from the stomach or from some part of the bowel itself.

But it often happens in such cases that the extravasated blood passes out of the body unnoticed. Too little is poured out at a time to cause vomiting. It is voided, therefore, by the bowels, and in its passage through them gets mixed with other matters, and is, besides, so much altered that it is no longer recognised as blood.

The same thing may happen in organic diseases of the heart, and in diseases of the lung, where the passage of the blood through the chest is much impeded. In consequence of the impediment to the onward course of the blood the stomach is kept in a state of congestion, and an oozing of blood from its mucous membrane now and then takes place. The blood extravasated at any one time is generally so small in quantity that it does not excite vomiting, and may thus pass out of the body unnoticed. Now and then, however, especially where the impediment to the circulation attains a high degree in a person not reduced by previous illness, the hemorrhage is abundant and blood is brought up in large quantities by vomiting. A few years ago I witnessed profuse vomiting of blood, clearly

brought on in this way, in a young man who was dying of rheumatic pericarditis, and who had for some days been suffering from the distressing fits of suffocation which large effusion into the pericardium occasions.

In the spring of the present year the same thing happened in a poor girl, seventeen years of age, named Emma Garret, who died in King's College Hospital of valvular disease of the heart, the result of rheumatic fever which she had twelve months before. She was brought into the hospital on the 4th of November, 1851, suffering much from pain at the præcordia, palpitation, and difficulty of breathing. On examination it was found that the heart was much enlarged, and that there was a systolic bellows-sound, which was loudest at the apex of the heart and along its left edge and on the left side of the chest behind—indicating a backward current of the blood through the mitral orifice. On the 27th of November, acute pericarditis came on, and a "to-and-fro" sound was heard. From this time the breathing was much embarrassed, and there was constant catarrh, and now and then, for a time, solidification of the lower lobe of one of the lungs.

On the 2d of March, she began to spit blood, and continued to do so until her death, which happened on the morning of the 9th. For two days before her death she had repeated vomiting of blood, which was clearly effused in consequence of the congestion of the stomach produced by the great impediment to the passage of the blood through the chest; for when the body was examined after death no ulcer, or even abrasion of the mucous membrane of the stomach was found.

Thus, when congestion of the stomach arises from hinderance to the return of its venous blood, whether the impediment be in the liver or in the chest, one of its most striking effects is an oozing of blood from the free surface of the mucous membrane. When the blood is poured out in large quantity, it causes sickness and is thrown up—or most of it is thrown up—by vomiting. When it is poured out little at a time, it passes through the bowels, and is frequently, perhaps generally, unnoticed.

The effects of congestion of the stomach are, however, somewhat different, as I have already hinted, according to the circumstances under which it occurs. When a great impediment to the passage of the blood through the liver or the chest is created rapidly, it is much more apt to cause hemorrhage from the stomach than when it is created gradually and slowly—doubtless because in the latter

case the bloodvessels of the stomach grow stronger, so as to better bear the additional stress upon them, which they must do by virtue of the power which bloodvessels everywhere have of becoming hypertrophied readily—that is, of growing rapidly stronger, or larger—when, by an altered condition of the circulation, tubes of greater strength or volume are required.

An impediment to the passage of blood through the liver or the chest, if it be created rapidly, usually causes hemorrhage from the stomach before it causes ascites: an equal impediment created slowly, causes ascites before it causes hemorrhage.

It has long been remarked, that mucous membranes are the only tissues in which blood escapes readily from the vessels. Hemorrhage never occurs in consequence of mere congestion, however it be brought on, in the serous or in the synovial membranes; hardly ever in the brain, in the substance of the liver, or in some other of the viscera.

The different mucous membranes vary much in their liability to hemorrhage from congestion. As a general rule, the liability to hemorrhage is greater the more active the function of the membrane. Some mucous membranes, as those of the œsophagus, the urethra, the urinary bladder, serve as a mere lining, and are little disposed to bleed, except from some direct injury done to their surface. Others, as those of the stomach, of the intestines, of the uterus, which, having a more active function and furnishing abundant secretions, are naturally more vascular, bleed readily from mere passive congestion or fulness of their vessels.

No tissue in the body is so prone to hemorrhage at all times and at all ages as the mucous membrane of the stomach. But, in all mucous membranes alike, it is only on the free surface of the membrane that the blood escapes in any quantity. In cases of the gin-drinker's liver, where blood has been oozing almost constantly for several days, or even weeks, from the open surface of the membrane, hardly a drop filters into the cellular tissue beneath; and after death the stomach often exhibits no stain or trace of the hemorrhage of which it had been lately the seat.

It has not yet, that I know of, been shown what is the peculiarity of structure in mucous membranes that allows the ready issue of blood from their vessels; or why it is that the blood issues only on the open surface of the membrane—why it is not poured out also on its under surface, so as to collect in the loose cellular tissue in which the vessels run.

Late researches on those structures have shown that mucous membranes consist of a layer of epithelium spread like a pavement on a thin and structureless membrane, which serves to support it; and that the blood-vessels run and ramify in the cellular tissue behind. From this it might have been expected that blood would be more apt to filter into the cellular tissue between the coats of the stomach than to exude from the open surface of the mucous membrane.

The cause of the blood's escaping only on the open surface of the membrane is clearly some mechanical condition. However the congestion be brought on, whether it be by impediment to the return of blood from the stomach or not, it is only on the open surface of the mucous membrane that the blood issues in any quantity. Again, if the stomach be injected with coloured size in the dead body, the size will ooze readily from the open surface of the mucous membrane, but seldom gets extravasated in any quantity on its under or attached surface so as to collect between the mucous membrane and the coats beneath.

Another circumstance of much interest and importance is, that although mucous membranes, and that of the stomach in particular, allow blood to issue readily from them, they do not, in states of mere congestion, however brought on, allow the serum of the blood, or the water of the blood, to escape without the red corpuscles.

In examining the bodies of men who have died with the gin-drinker's liver, I have often been surprised that while the belly was enormously distended by a dropsical fluid in the peritoneal sac, and while the coats, even of the intestines, or of some parts of them, were œdematous, there should have been no flux, no drain of fluids from the bowel itself, beyond the scanty oozing of blood of which I have already spoken.

When the stomach and intestines are long kept in a state of congestion from a bar to the passage of the blood through the liver or the chest, the nutrition of the mucous membrane is less active than in health, its peculiar and solvent juices are more sparingly secreted, and, in consequence, digestion is slower and more feeble; and unless an inflammatory condition of their lining membrane be caused by the irritation of imperfectly digested food, the bowels are apt to be costive.

Analogous effects are produced by a state of passive congestion in every other organ. The unnatural fulness of the vessels, and the slowness of the current through them, lessen the activity of the nutritive processes, limit the supply of oxygen which is essential to

the development of every living force, and thus diminish the *power* of the organ, of whatever kind that power may be.

If, from organic disease of the heart, the brain be kept in a state of congestion, the evolution of the nervous force is hindered—the feelings and sensations are blunted, the will is less energetic, the muscular movements are less vigorous and precise, and the intellectual power is diminished—and all this to a certain extent independently of the increased pressure on the nervous substance which a state of congestion occasions.

Again, if the vessels of the lungs be kept congested, dropsical fluid may collect in the sac of the pleura, or even in the spongy tissue of the lung itself, which will, of course, clog the lung and shorten the breath; but, quite independently of this, the mere state of congestion—the distention, that is, of the capillary vessels, and the slowness of the current through them—hinders the proper function of the lung, lessens the absorption of oxygen and the exhalation of carbonic acid, and, if the congestion be great, causes distress, or difficulty, in breathing.

So, again, if the kidney be kept in a state of congestion, some of the albumen and of the red corpuscles of the blood may escape with the urine; but the excretion of water and of the proper saline constituents of the urine is diminished.

Analogous effects are produced in the muscles. In cases of organic disease of the heart, where the current of blood through the chest is greatly impeded, the muscles are inadequately nourished, and, in consequence, they soon tire and only slowly recover their fatigue. If the congestion be long kept up, the muscles waste. In diseases of the heart the blood returns less freely from the legs than from other parts, and when the œdema of the legs, which is so common in these diseases, goes off for a time, the muscles are always found flabby and small, much more shrunk than the muscles of the arms and of other parts of the body.

The effect of impeded circulation in everywhere hindering the processes of nutrition, is, perhaps, best seen when disease of the valves of the heart comes on in childhood.

From that time, if the disease should much impede the course of the blood through the chest, the child is checked in its growth and dwarfed, and the age of puberty is much deferred.

It is then in accordance with a general law, that when the stomach is kept in a state of passive congestion from a bar to the current of the blood through the liver or the chest, the secretion of

the gastric juice is diminished, the stomach can digest less food, and requires longer intervals of rest.*

It is another fundamental effect of these conditions, that in the same measure in which the proper nutrition of the texture is hindered, is its power enfeebled to resist an injurious influence of any kind.

If, under these circumstances, food is taken which is difficult of digestion or more food is taken than the stomach can master, some of it remains long undigested in the stomach, and irritates, and at length inflames the mucous membrane. The congestion of the stomach is thus increased; the afflux of blood and the more complex changes caused by inflammation are added to the pre-existing passive congestion; and the digestive power, if not entirely suspended, is rendered very much weaker than it was before.

Again, if alcoholic drinks be taken in undue quantity, as they often are in the hope of supporting the strength, or if irritating medicines be given, they are only slowly absorbed into the general circulation, and are thus especially apt to exert an injurious action on the coats of the stomach itself.

In the treatment of all diseases which cause much impediment to the passage of the blood through the liver or the chest, it is very important that the congestion of the stomach and the feebleness of digestion that necessarily results from it should be borne in mind. The congestion of the stomach is, indeed, secondary, and is relieved by whatever lessens the impediment to the circulation on which it depends; but, while it lasts, both food and physic should be regulated with reference to it. A sparing and easily digestible diet, and, when the nervous system can bear it, total abstinence from fermented drinks, is the regimen best suited to such cases. When alcohol is necessary, it should be given sufficiently diluted; and when mercury and diuretics are deemed expedient for the object of relieving the embarrassed circulation, their action on the stomach should be carefully watched.

Unless, indeed, the diet be properly regulated and care be taken not to fret the stomach by irritating drugs, a persistent congestion of the stomach leads to an inflammatory condition of its mucous

* Recent researches have led to the inference that the amount of the gastric juice, and therefore the amount of materials needed for its supply, is much greater than has been hitherto imagined. Lehmann estimates that not less than four pounds of gastric juice is secreted daily by a man in health.—Lehmann's "Physiological Chemistry." Translation by Dr. Day, vol. ii. p. 53.

membrane almost as surely as a persistent congestion of the lung leads to bronchitis.

Hitherto, I have spoken only of the simplest kind of congestion —the mere turgescence of the vessels of the stomach, which results from a mechanical impediment to the passage of the blood through the liver or the chest. But a plethora, or fulness of the vessels, may result from very different conditions. The purpose of the blood is to supply materials for the nutrition of the various tissues of the body and for those secretions by which the purity of the blood itself is maintained; and the quantity of blood which flows to any part, and the freedom with which the stream traverses its capillary vessels, depend very much on the affinity or mutual action between the elements of the part and the blood. The natural affinity between the blood and the tissues, (varying in degree according to the state of action or repose,) which is requisite for healthy nutrition, may be modified, and the circulation, in consequence, deranged by changes originating either in the tissues or in the blood. Thus, when inflammation of the mucous membrane of the stomach is set up by undigested or irritating food or when any other injury is done to it which nature has to repair, more blood flows to the stomach, and more is retained in its vessels, while the inflammation or the reparative process exists. So, again, if the coats of the stomach be the seat of a cancer, the wonderful powers of growth in the new tissues draw an additional quantity of blood to the stomach and cause an unnatural fulness of its vessels. After a time, indeed, in consequence of the increase in the volume of the current, the arteries and veins which serve as its channel grow larger.

The congestion of the stomach that results from inflammation, or from the growth of a cancer, or from other structural changes, will be considered when these several conditions come under our notice, and therefore need not detain us now. But, as I have just stated, congestion may originate not only in an unnatural condition of the tissues which the blood nourishes, but also in an unnatural condition of the blood itself. A change in the relative proportion of the constituents of the blood, or the presence of some foreign matter in it, by changing the consistence of the blood, and thus rendering its propulsion more difficult, or by modifying the chemical relation which naturally exists between the blood and the tissues, may cause the blood to pass less freely than natural through the capillary vessels, and so to accumulate in them.

In every secreting organ, the circulation is especially modified by those unhealthy states of the blood which especially influence the secretion. The secreting organs are the outlets through which noxious or *effete* matters are removed from the body. Some matters are removed principally by one secreting organ, some by another. Every kind of matter is removed in greatest quantity by the organ which has the greatest affinity for it. The very act of secretion implies a special affinity between the secreting structure and those elements of the blood which go to form the secretion; and the exercise of this affinity, as a matter of necessity, influences the current of blood. Its first effect is to draw an increased quantity of blood to the part, to cause an increased quantity to pass through it in a given time, and, generally, to render the nutrition of the part more active. If, however, the matter to be eliminated is more than the organ has power to cast off, the blood is unduly detained there, the minute vessels of the organ become gorged, and all those effects ensue which result from the simpler kind of congestion we have before considered.

The vascular plethora of the stomach, for example, that results from an unnatural condition of the blood, like the congestion that is caused by an impediment to the return of the venous blood, lessens the secretion of the gastric juice, renders the mucous membrane more disposed to be inflamed by the irritation of undigested or unwholesome food, and, if the congestion attain a certain degree, causes an oozing of blood from the open suface of the membrane.

Vomiting of blood, especially when it is in small blackish coagula, which show that the blood escaped by oozing and that it was coagulated before it had time to collect in a mass, is, perhaps, the most distinct and conclusive evidence of congestion of the coats of the stomach.

There are probably many morbid states of the blood that lead to congestion of the stomach and to the consequent exhalation of blood from the open surface of its mucous membrane.

Hemorrhage from the stomach, arising in this way, now and then occurs in women, from a stoppage of their monthly courses. A very striking instance of this is related by Dr. Watson, on the authority of Dr. Latham:—"A young woman became the subject of hæmatemesis, recurring at monthly periods, about the age of fourteen. She had never menstruated. This continued until she married, and in due time fell with child. Thereupon the hæmatemesis ceased. She brought forth and suckled her infant. During lacta-

tion the hemorrhage did not recur. It came on again soon after she ceased to nurse the child, no regular menstruation by the uterus having ever happened. This was the woman's own account, and there appeared no reason to question its accuracy."

Hemorrhage of the stomach, arising from suppressed menstruation, generally occurs, as it did in this instance, at the appointed time, or near the appointed time, of the natural monthly discharge. While it lasts, the power of digestion is suspended and the stomach is painful and tender. It was rightly remarked by Cullen, that this kind of gastric hemorrhage hardly ever proves fatal. The blood generally escapes by oozing from the open surface of the mucous membrane, and, when a certain quantity is lost, the system is relieved, as by natural menstruation, and the disposition to hemorrhage ceases.

Even when this vicarious hemorrhage takes place from an ulcer in the stomach, as I believe it not infrequently does, the blood does not issue from a vessel of considerable size laid open by the process of ulceration,—the usual source of hemorrhage in cases of the simple or perforating ulcer,—but oozes from the minute vessels of the raw surface.

Hemorrhage vicarious of menstruation usually takes place from an ulcerated surface or from the open surface of those mucous membranes which are most disposed to bleed. It takes place more frequently from the mucous membrane of the stomach than from any other mucous membrane, because the mucous membrane of the stomach is frequently, like the mucous membrane of the uterus at the time of menstruation, the source of an abundant secretion, and, in adaptation to this more active secreting function, is more vascular and more readily allows an exudation of blood from its surface than the mucous membrane in other parts.

Vomiting of blood resulting from suppressed menstruation is distinguished from that which results from other causes by its occurring at the time and in place of the natural menstrual discharge; by the absence of other conditions, such as an impediment to the passage of the blood through the liver or the chest or great enlargement of the spleen, which are known to lead to congestion of the stomach; and, when the hemorrhage does not take place from an ulcer, by the circumstance that the disorder of the stomach is of short continuance—that the vomiting of blood is not long preceded, or long followed, by pain, vomiting, or other symptoms that denote organic disease of this organ.

The means most effectual in arresting the vomiting of blood that results from suppressed menstruation, are—the abstraction of a small quantity of blood from the arm; the application of a blister to the epigastrium; cold and slightly astringent drinks; unloading the bowels by a purgative injection; and complete abstinence from food. When the hemorrhage has ceased, the remedies most likely to prevent its recurrence, are—some bitter astringent, to brace the coats of the stomach; sulphate of magnesia, or some other saline purgative, in sufficient quantity to promote a free action of the bowels, and thus to prevent the congestion of the stomach which a loaded state of the large intestine occasions; and, in conjunction with these remedies, the employment of all available means which tend to promote the natural monthly courses.

In the various diseases which are attended with an abundant and morbid secretion from the coats of the stomach, whether this secretion results from a poisoned state of the blood or from a poison in the stomach irritating the surface of the mucous membrane, hemorrhage from the stomach not unfrequently takes place.

In malignant cholera, for example, it sometimes happens that, after the discharges have continued some time and while they are still profuse, the matter ejected from the stomach, instead of having its usual appearance, which has caused it to be compared to "whey" or "rice-water," is brown, or blackish, from the presence in the whey-like fluid of brown or black flakes, sufficiently numerous to impart their colour to the whole mass. When the matter is poured on a filter, the colourless liquid transudes, and the brown or black flakes are left on the filter. These brown or black flakes consist of minute coagula of blood, which has exuded from the mucous membrane of the stomach, and has been coagulated and blackened before it has had time to collect in a mass. In cases in which this black vomit occurs, the matter discharged from the bowels has often a reddish or plum colour from the presence of blood which has exuded from the mucous membrane in some part of the small or large intestine, where it is not exposed to the action of an acid, and, consequently, is not clotted and blackened, as it is in the stomach.

After death from cholera, the vessels of the stomach and intestines are found congested, and in those cases in which hemorrhage has occurred some ecchymosed spots may usually be seen on the mucous membrane, marking, no doubt, the chief sources of the effused blood.

It is very important, in the treatment of cholera, to consider the

nature of the process of which the stomach is the seat. The abundant flux from the mucous membrane, which results not from mere passive congestion, but from an active process of secretion; the burning heat which is usually felt there; the craving for cold drinks; and the great vascularity of the stomach which may be seen after death—all speak the same language and forbid the use of alcoholic drinks and of acrid and stimulating drugs, which have been often resorted to in cholera with the view of keeping up the temperature of the body and supporting the strength, but which, unless they have some specific action, must, by irritating the coats of the stomach, tend still further to increase the flux, and thus to hasten the collapse which they are given to prevent.

In yellow fever, again, hemorrhage from the stomach (which appears to be the cause of the characteristic black vomit*) takes place by oozing from the mucous membrane; and the blood as it exudes, is blackened by the acrid secretions with which it is mixed. It seems that in yellow fever, as in cholera, the hemorrhage from the stomach is preceded by an abundant secretion from the mucous membrane. Sir William Pym, describing the symptoms of one of the forms of yellow fever, says:—"In many cases, the patient in a few hours begins to be troubled with flatus of the stomach, and distressing hiccough, and is suddenly and unexpectedly seized with faintness, sickness, and painful retchings, followed by vomiting at first of whatever had been taken as food or drink, and very soon after by a brownish fluid, resembling dirty water, mixed with a dark-coloured flaky matter, which floats upon its surface; and, at last, by a matter resembling coffee-grounds. . . . The quantity of fluid ejected, in most cases, wonderfully exceeds the quantity drunk; indeed, all the fluids in the body seem to be pouring into the cavity of the stomach; for when it has, to all appearance, been emptied several times, and the patient thinks himself relieved from any further painful straining, he is, in the course of a few minutes, without having tasted drink, under the necessity of again having re-

* Dr. Hassall has recently thrown doubt on the generally received opinion that "the black vomit" of yellow fever owes its colour to the presence of blood. In a specimen which he examined under the microscope he found, among other objects, a vast number of irregular bodies, frequently brown, and somewhat resembling blood-discs, shrivelled and discoloured, but insoluble in acetic acid. These bodies constituted the most peculiar matter of the "vomit." From their insolubility in acetic acid, he thinks it improbable that they are altered blood-discs, and conjectures that they may be sporules of a fungus, and that they may be important agents in keeping up the vomiting.—*Lancet*, Feb. 12, 1853.

course to the basin. The vomiting, in the latter hours of the disease, is attended with a peculiar loud and hollow noise, which is heard at a great distance, and is a most painful and distressing sound (particularly in camp) to those who are aware of the sufferings of the patient."

Every one who has had charge of a cholera hospital will be struck with the strong resemblance which the gastric disorder in some cases of cholera bears to that which is so graphically described in the preceding passage.

Hemorrhage from the stomach, produced in the same way, occurs now and then, though very rarely, in the course of typhoid fever. In the month of July, 1853, a fatal case of this kind fell under my notice. A young man, twenty-one years of age, previously healthy, had been ill of typhoid fever, with occasional vomiting, but no severe general symptoms, for three weeks, when black vomit came on. The vomiting of black matter (blood coagulated in small portions and blackened) recurred frequently, and he died of exhaustion three or four days after the first occurrence of hemorrhage.

Another cause of congestion of the stomach, often leading to an oozing of blood from its mucous membrane, is arrest of secretion in the liver.

The blood is drawn to the liver, and its passage through the liver is promoted, by the forces which are there at work separating and elaborating the principles of the bile and effecting those reparative changes in the blood which the agency of the liver causes. When the action of these forces is suspended the blood does not pass through the liver with its usual freedom, and the stomach and intestines become congested, just as when a palpable mechanical bar is opposed to the free return of the venous blood.

In those terrible cases in which jaundice, followed by fatal disorder of the brain, results from suppressed secretion of bile, hemorrhage from the stomach and bowels is a common event.

Again, in cases of jaundice, from permanent closure of the common gall-duct, which prove fatal by gradually exhausting the strength, it not unfrequently happens that after the jaundice has lasted many months, and when the secreting cells of the liver are destroyed, death is hastened by the occurrence of hemorrhage in the stomach and bowels.

In either class of cases the hemorrhage occurs without ulceration of the mucous membrane of the stomach or intestines, and is

best explained by supposing that it results from congestion of the stomach and intestines, caused by the complete arrest of secretion in the liver.

Hemorrhage from the stomach now and then occurs also in persons in whom the spleen has for some time been greatly enlarged. Numerous instances of this have been recorded, from the time of Morgagni downwards: but the true relation of the facts has not been made out. A very important circumstance in the history of such cases is, that the vomiting of blood is preceded or attended by ascites, by enlargement of the superficial veins of the belly, and by other symptoms which show that the passage of the blood through the liver is greatly obstructed; and the question arises, On what does this obstructed circulation depend?

The most natural supposition is, that the obstructed circulation results, not from the disease of the spleen, but from obstruction of branches of the portal vein, or some other organic changes in the liver, and that it is caused, as is cirrhosis, by a mechanical bar to the passage of the blood.

A circumstance somewhat against this supposition is, that obstructed circulation through the liver does not commonly cause great enlargement of the spleen; and that, in most of the recorded cases in which vomiting of blood has been associated with enormous enlargement of the spleen, the enlargement of the spleen has been the effect of ague, which does not often lead to obliteration of the veins of the liver or to other organic changes which impede the passage of blood through it. It is for morbid anatomy to settle this point. Only one opportunity of elucidating the subject by dissection has fallen to me; and, in that instance, I failed to discover any mechanical impediment to the passage of the blood through the liver.

The question then occurs, Does not some degree of impediment to the passage of blood through the liver, in such cases, result from an unnatural condition of the blood itself, in consequence of suspended action of the spleen? There can be little doubt that the spleen contributes, like the liver, to the reparation of the blood. If either of those organs be much diseased, a state of lasting anæmia results. It seems not unlikely, from the anatomical relation of the two organs, that the changes effected by the spleen are preparatory to those effected by the liver; and that, if the former changes be prevented, the blood that flows to the liver may not be in healthy relation to its secreting cells; and, in consequence, its course through the capillary net-work of the lobules may be in

some degree hindered and a disposition to ascites and gastric hemorrhage result.

As I have before observed, it is for morbid anatomy to decide if this supposition be true.

It now and then happens that hemorrhage of the stomach from overfulness of its bloodvessels, instead of being the effect of a single condition, is attributable partly to obstruction to the current of blood through the liver, rendered more effective, it may be, by feeble propulsive power in the heart, and partly to an unhealthy condition of the blood itself disposing to hemorrhage, which is sometimes brought on by watching, mental anxiety, or other depressing influences.

If time permitted, I could cite more than one instance in which excessive vomiting of blood seemed to have been thus produced.

With respect to hemorrhage of the stomach from congestion, it is important to bear in mind that dark shreds are sometimes vomited, which are hardly to be distinguished by the naked eye from shreds of coagulated and darkened blood, but which consist of flakes of gastric mucus coloured by tea, or by some other dark-coloured liquid recently swallowed. In such cases the microscope enables us to ascertain readily that the dark matter does not owe its colour to the presence of blood.

LECTURE IV.

Inflammation of the Stomach—its various kinds or degrees: 1st. Inflammation excited by Undigested Food, or Alcoholic Drinks; 2ndly. Inflammation caused by more powerful Mechanical or Chemical Irritants; 3rdly. Inflammation resulting from Defective Nutriment, or from the presence of Noxious matter in the Blood.

HAVING spoken of the effects of congestion of the stomach, I have now to call your attention to those of *inflammation* of its lining membrane.

The term, inflammation, is generic, and, in the latitude now given to it, comprehends processes which, although they have many points in common, differ in very important particulars. Taking the case of the synovial membranes,—the inflammatory process may lead to the effusion of a watery fluid, which may be completely absorbed; or to the effusion of coagulating lymph; or to the secretion of pus: and it is observed, that the result in any individual case is

mainly determined by the nature of the agent by which the inflammation is kindled. The inflammation of rheumatism leads to the effusion of a serous fluid, which, at least, does not undergo coagulation in the synovial capsule. The inflammation that results from a penetrating wound, or from the presence of pus in the blood, generally leads to the secretion of pus. But, in either case, there are many common phenomena. There is increased flow of blood to the part and a plethora or fulness of its bloodvessels; increased heat from the increased oxidation and other chemical changes which are there going on; and unnatural swelling from the effusion of fluids if the effused fluids cannot readily escape. Again, whatever be the cause or the result of the process, the blood undergoes the same fundamental change in its physical properties,—a change which, as M. Andral has shown, is mainly dependent on an increase in the proportion of its coagulable element. It is to these constant phenomena, that the generic term "inflammation" is properly applied. But, whenever the term is used, it must be recollected that it is a generic term, and that, in speaking of any individual case, it is not enough to say that the disease is inflammation of this or that part. To convey an exact notion of the changes that are taking place, it is necessary to specify, in some way or other, the *kind* of inflammation, either by reference to the cause of the inflammation, as by saying that it is *rheumatic* inflammation or *gouty* inflammation or *syphilitic* inflammation or *erysipelatous* inflammation; or, if the cause be unknown, by reference to the nature of the fluids effused, as by saying that the inflammation is suppurative or adhesive.

The matters effused in inflammation vary not only with the nature of the agent by which the inflammation is kindled, but also according to the tissues inflamed. The inflammation of the joints which occurs in rheumatic fever leads to the effusion of a fluid which does not coagulate, and which is in most cases readily absorbed, so that no permanent damage results. The inflammation of the pericardium and of the valves of the heart, which so frequently co-exists with the inflammation of the joints and which is doubtless excited by the same agent, leads to the effusion of coagulable lymph, and produces lasting, and often fatal, changes of structure.

The inflammation of a mucous membrane may lead, according to the kind of inflammation—1st. To the secretion of viscid, or opaque, or otherwise altered mucus; 2nd. To the effusion of plastic lymph, which forms a coating like a layer of coagulated albumen, on the

membrane; 3rd. To the formation of pus: but, whatever be the character of the matter effused, no permanent mischief need follow.

The morbid product is poured out on the open surface of the membrane, and is cast off; and, when the process of inflammation is ended, the membrane may be restored to its original condition.

The various results of inflammation in mucous membranes are best studied in the air-tubes, because the several kinds or degrees of inflammation I have just referred to are common in them and are readily distinguished from the circumstance that the secretions from the inflamed membrane are spit up, unmixed with other matter, and may likewise be found, unchanged, choking the tubes in the dead body. But with regard to the stomach the case is widely different. If any part of the mucous membrane of the stomach be inflamed, the matters secreted by this part are mingled with the secretions of other parts and also with the food which the stomach contains; and they must, besides, be speedily changed by the chemical action of the gastric juice. If, therefore, they are thrown up by vomiting, it must, in most cases, be difficult to distinguish their primary form; but if, instead of being thrown up, they pass downwards through the bowel, they must be still further altered by admixture with the bile, the pancreatic juice, and the fluids poured out by the coats of the bowel itself, as well as by the chemical changes which are then going on. It cannot, then, excite much surprise that but little has been learned respecting the inflammatory diseases of the mucous membrane of the stomach from an inspection of the matters which the inflamed membrane secretes.

But there is another difficulty in the study of these diseases—they seldom prove fatal; so that opportunities of examining the inflamed membrane itself seldom occur. Inflammation of the air-tubes not unfrequently destroys life, not by the constitutional disturbance which the process of inflammation excites, but by the mere mechanical effect of the secretion, which blocks up the smaller tubes, and thus suffocates the patient.

Secretions from the mucous membrane of the stomach cause no mechanical obstruction of this kind, so that inflammation of it seldom proves fatal. After a time the inflammation subsides and leaves no trace behind.

Again, when death does occur during the active stage of the process, the marks of this process are much less certain than in inflammatory diseases of the air-tubes. The secretions are changed by mixture with what else there may happen to be in the stomach; and

a softening or destruction of the mucous membrane, which, in the air-tubes, would at once be ascribed to disease, may here have occurred after death from the chemical action of the gastric juice, or of the other matters which the stomach contains.

For all these reasons, our knowledge of the inflammatory diseases of the mucous membrane of the stomach is extremely vague.

One of the simplest forms of inflammation of the mucous membrane of the stomach, as well as one of the most frequent, is that brought on by excess in eating or drinking. Much has been added to our knowledge on this subject by the observations of Dr. Beaumont on Alexis St. Martin, who, in consequence of a gun-shot wound, had a permanent fistulous opening through the abdominal parietes into the stomach, thus affording Dr. Beaumont the rare opportunity of *seeing* much of what took place in the stomach during the process of digestion.

Dr. Beaumont found that whenever St. Martin ate heartily of substances hard of digestion for some days in succession, an inflammatory state of the mucous membrane of the stomach resulted. The membrane exhibited aphthous patches and red spots, from which small drops of blood sometimes exuded. It secreted very little proper gastric juice, but a considerable quantity of ropy mucus, which became yellowish, or muco-purulent, when the inflammation was more than commonly severe.

This condition of the stomach caused slowness of digestion, so that food sometimes remained in the stomach undigested for twenty-four or forty-eight hours, or even longer. It caused, also, slight tenderness at the pit of the stomach and a thin white coat on the tongue, but very little constitutional disturbance. Under the influence of low diet and cooling drinks, the inflammation very speedily subsided and the membrane regained the appearance of health.

These effects are illustrated by the following experiments by Dr. Beaumont, on Alexis:—

On the 7th of December, Alexis had some symptoms of gastric derangement, and the mucous membrane of the stomach exhibited small aphthous patches.

At 9 o'clock, on the morning of the 8th of December, he finished breakfasting on fried sausage, dry toast, and a pint of coffee. At half-past 10, the stomach was full of fluids, and its mucous coat was red and irritable, inclining to dryness. There was a thin whitish coat on the tongue, and a similar appearance on the protruded portion of the stomach. At a quarter before 12,—that is,

at the end of nearly three hours,—the stomach was still full, and rancid oil floated on the top of its contents.

At a quarter before three on the same day, Dr. Beaumont placed in the stomach, suspended on a string, a roasted oyster, that weighed, when raw, four drachms; and Alexis ate twelve others of about the same size.

At half-past four, the oyster on the string was not half-digested, and Alexis complained of headache, lassitude, dull pains in the left side and across the breast. The tongue was furred with a thin yellowish coat, and inclined to dryness. The eyes were heavy and the countenance was sallow. The mucous membrane of the protruded portions of the stomach, according to Dr. Beaumont, very much resembled the appearance of the tongue, with small aphthous patches in several places, quite irritable and tender.

Dr. Beaumont then suspended his observations and, at night, dropped into the aperture six grains of blue pill and four common-sized aloetic pills, and sprinkled on the exposed surface of the stomach five or six grains of calomel.

The medicine operated early the next morning, relieved the symptoms of indisposition, changed the appearance of the stomach and tongue, and removed the aphthæ.

On the 9th, that is, the day after the experiments were made, Alexis felt quite well, and the coats of the stomach looked healthy again.

The rapid recovery in such cases is owing to the active nutrition of the mucous membrane. In consequence of this active nutrition, the effects of inflammation of the mucous membrane of the stomach are much more transient than those of inflammation of the mucous membrane of the air-tubes, or of the urinary bladder, or of the urethra, or even of the intestines.

The mucous membrane of the air tubes, or of the urethra, or of the urinary bladder, wastes but little, and is slowly renewed. If it be much injured, the process of repair is long.

The mucous membrane of the stomach, on the contrary, has an active function. Its epithelium is frequently shed to effect digestion, and is rapidly renewed; and, in consequence, the superficial inflammation of it we are considering is very transient.

The erythematous inflammation of the stomach, in the instance I have just cited from Dr. Beaumont, was brought on by eating fried sausages and roasted oysters. The effect which these or any other unwholesome articles of food have on the stomach, of course depends

greatly on the previous state of the stomach and of the general health. What at one time is readily digested and does no harm, at another time is digested very slowly and frets and inflames the stomach. Food which under ordinary circumstances is most wholesome may thus inflame the stomach, if, by an impediment to the passage of the blood through the liver or the chest, or by a state of fever, or by nervous exhaustion, or by previous excesses, the gastric juice is, for the time, diminished.

The stomach may be inflamed by alcoholic drinks, just as it is by unwholesome food. This was repeatedly seen by Dr. Beaumont in his observations on St. Martin. The following passages are very instructive on this point:—

"July 28th, 9 o'clock, A. M.—Weather clear; wind N. W., brisk; thermometer 66°. Stomach empty; not healthy; some erythema and aphthous patches on the mucous surface. St. Martin has been *drinking ardent spirits, pretty freely, for eight or ten days past;* complains of no pain, nor shows symptoms of any general indisposition; says he feels well, and has a good appetite.

"August 1st, 8 o'clock, A. M.—Examined stomach before eating anything; inner membrane morbid; considerable erythema, and some aphthous patches on the exposed surface; secretions vitiated. Extracted about half an ounce of gastric juice; not clear and pure as in health; quite viscid.

"2nd, 8 o'clock, A. M.—Circumstances and appearances very similar to those of yesterday morning. Extracted one ounce of gastric fluids, consisting of unusual proportions of vitiated mucus, saliva, and some bile, tinged slightly with blood, appearing to exude from the surface of the erythema and aphthous patches, which were tenderer and more irritable than usual. St. Martin complains of no sense of pain, symptoms of indisposition, or even of impaired appetite. Temperature of stomach 101°.

"3rd, 7 o'clock, A. M.—Inner membrane of stomach unusually morbid; the erythematous appearance more extensive, and spots more livid than usual, from the surface of some of which exuded small drops of grumous blood; the aphthous patches larger, and more numerous; the mucous covering thicker than common, and the gastric secretions much more vitiated. The gastric fluids extracted this morning were mixed with a large proportion of thick ropy mucus, and considerable muco-purulent matter, slightly tinged with blood, resembling the discharge from the bowels in some cases of chronic dysentery. Notwithstanding this diseased appearance of

the stomach, no very essential aberration of its functions was manifested. St. Martin complains of no symptoms indicating any general derangement of the system, except an uneasy sensation, and a tenderness at the pit of the stomach, and some vertigo, with dimness and yellowness of vision on stooping down and rising again; has a thin, yellowish-brown coat on his tongue, and his countenance is rather sallow; pulse uniform and regular; appetite good; rests quietly, and sleeps as well as usual.

"4th, 8 o'clock, A. M.—Stomach empty; less of those aphthous patches than yesterday; erythematous appearance more extensively diffused over the inner coats, and the surface inclined to bleed; secretions vitiated. Extracted about an ounce of gastric fluids, consisting of ropy mucus, some bile, and less of the muco-purulent matter than yesterday; flavour peculiarly fetid and disagreeable; alkalescent and insipid; no perceptible acid; appetite good; rests well, and no indications of general disease or indisposition.

"5th, 8 o'clock, A. M.—Stomach empty; coats less morbid than yesterday; aphthous patches mostly disappeared; mucous surface more uniform, soft, and nearly of the natural healthy colour; secretions less vitiated. Extracted two ounces of gastric juice, more clear and pure than that taken for four or five days last past, and slightly acid; but containing a larger proportion of mucus, and more opaque than usual in a healthy condition.

"6th, 8 o'clock, A. M.—Stomach empty; coats clean and healthy as usual; secretions less vitiated. Extracted two ounces of gastric juice, of more natural and healthy appearance, with the usual gastric acid flavour; complains of no uneasy sensations, or the slightest symptom of indisposition; says he feels perfectly well, and has a voracious appetite; but not permitted to indulge it to satiety. He has been restricted from full, and confined to low diet and simple diluent drinks for the last few days, and has not been allowed to taste any stimulating liquors, or to indulge in excesses of any kind."

In this instance, the inflammation of the stomach was caused by *ardent* spirits. The effect which these have on the stomach depends greatly on their state of dilution. The more they are diluted, the less apt are they to irritate and inflame the stomach. It has long been known that *spirit*-drinkers are the especial victims of cirrhosis, which has, in consequence, been called, in this city, "the gin-drinker's liver;" and it has been very generally supposed that distilled or ardent spirits hurt the stomach more, than fermented

liquors, even when the spirits are diluted with water so as to be of the same strength. But in wine and malt liquors the alcohol exists in a state of mere admixture with their other constituents, and there can be little doubt, therefore, that the more injurious effects of ardent spirits depend mainly on the circumstance that the victims of spirit-drinking not only drink large quantities of spirits, but often drink them "neat" and on an empty stomach. In wine and beer the alcohol is already largely diluted, and the beverages, when drunk to excess, are usually drunk at, or soon after, meals, when the alcohol is still further diluted by admixture with the contents of the stomach.

The effect of spirits on the coats of the stomach, like that of food which is hard of digestion, depends greatly on the previous state of the stomach and of the general health, as well as on season and climate. Spirits hurt the stomach more when its mucous coat is already inflamed, or when, from an impediment to the passage of the blood through the liver or the chest, or from any other cause, the vessels of the stomach are congested, so that liquids are slowly absorbed from it; and in hot seasons or hot climates. Under these circumstances, small quantities of fermented drinks may do much mischief.

In the observations I have cited from Dr. Beaumont, nothing is more striking than the rapidity with which the stomach recovered under the influence of low diet and cooling drinks. Without this power of rapid recovery the stomach would be unfit for its office. If the erythematous inflammation which is excited by unwholesome food or by excess in eating or drinking took long to subside, the abstinence required for recovery could hardly be borne.

The inflammation, instead of subsiding rapidly, is, however, often long kept up and is sometimes aggravated, from the circumstance that the disorder causes but slight constitutional disturbance, and that the appetite is less impaired than the digestive power. The usual diet is in consequence taken, and the tender surface fretted. Quantities of solid food or of fermented drinks, which at other times would do no harm, are sufficient to keep up a soreness that already exists.

The chronic inflammation so excited is attended with an increased secretion of mucus, and causes a thickening, and the so-called "mammillated" appearance, and occasionally, I believe, minute superficial ulcers of the mucous membrane. Its most characteristic symptoms are—constant slight tenderness at the epigastrium;

slowness of digestion; pain or uneasiness in the stomach, and occasional vomiting, after meals, especially after meals of solid food; and a white and furred tongue. The matter vomited contains viscid mucus, which, now and then, presents a few streaks of blood, more or less altered. The disorder, even after it has lasted a considerable time, generally disappears readily if the stomach be allowed sufficient intervals of rest, or the patient be restricted to cooling drinks and a diet consisting entirely of farinaceous substances and milk.

A superficial, or erythematous, inflammation of this kind occurs, not only as a disease by itself in persons otherwise healthy, but also very frequently in the course of various other inflammatory or febrile diseases, when the food has not been brought down to the diminished power of the stomach. Under such circumstances the inflammation of the stomach is more difficult to recognise, from its symptoms being complicated, or masked, by those of the primary disease. It is thus often overlooked, and much mischief is in consequence done by the unseasonable use of stimulants.

Chronic inflammation of the kind we are now considering sometimes results, not from the digestive powers of the stomach being overtaxed, but from the existence of some impediment to the passage of the digested food from the stomach into the intestine. When, for example, a simple deep ulcer exists near the pyloric end of the stomach interfering with the action of its muscular fibres, or when the pyloric orifice is slightly strictured, or is pressed upon by a large liver, the stomach cannot always completely empty itself, and what remains in it after digestion is over, frets and inflames its mucous coat. As the inflammation in such cases results from an abiding condition, it is difficult to remedy, and thus, occasionally, leads to habitual vomiting of ropy mucus. This happened in a woman who died a few years ago, in King's College Hospital, from the effects of a large simple ulcer near the pyloric end of the stomach. Much ropy mucus was vomited for a long time before death, leading to the suspicion of cancer of the stomach, and, after death, ropy mucus of the same kind, hard to detach, was found coating almost the whole surface of the mucous membrane.

In the same way, if the urinary bladder or the gall-bladder cannot completely empty itself, the retained urine or bile decomposes, or becomes too highly concentrated, and consequently frets and inflames the mucous membrane. Inflammation of the mucous membrane of the stomach would be caused in this way much more frequently, if it were not for the circumstance that the stomach has

two outlets, and that when the pyloric outlet is stopped, any irritating matters it may happen to contain can be cast off by the mouth.

A higher degree of inflammation, brought on in the same way—by direct irritation of the stomach—is seen in persons who have swallowed some hard and insoluble substance which lacerates and frets the mucous membrane, or some poison whose action on the membrane is corrosive. The immediate effects of this are—pain in the stomach, with a sense of heat there, and occasional vomiting, the matters vomited being tinged with blood. If the injury done to the stomach be very great or the pain be very severe, the heart's action is much depressed, as in severe forms of peritonitis—the pulse becomes small and rapid, the skin cold and clammy, and the countenance shrunk. When this state of depression passes away, a slight degree of fever comes on; but, unless the inflammation of the stomach be excited by some agent which has become absorbed into the blood and has thus affected other organs, the constitutional disturbance is but slight. Some years ago a theory was promulgated which ascribed the terrible constitutional disorder that exists in continued fever to inflammation of the mucous membrane of the stomach, or of the stomach and intestines; and, according to this theory, the different forms of continued fever were spoken of as gastritis and gastro-enteritis. In the most elaborate essay on typhoid fever yet published, the disease is designated "gastro-enteritis." But among the stores of medical literature are many remarkable cases, which show that simple inflammation of the stomach, however severe, does not, after the first shock of the injury has passed away, cause great nervous or constitutional disorder. The stomach—the common receptacle of all that is eaten and drunk—liable to receive a great number of substances which are mechanically or chemically irritating to it, and destined to exert its wonderful power imperceptibly, is so organized and in such relation to other parts of the system, that great and continuous irritation of its mucous membrane sometimes exists unattended by alarming constitutional disorder.

The most remarkable instance on record of long-continued mechanical irritation of the stomach is that of a sailor who died in Guy's Hospital in 1809, from having, in imitation of a juggler, foolishly swallowed fourteen clasp knives, most of which were nearly four inches long and full an inch in their extreme breadth.

In this instance, the mechanical irritation of the stomach, and

the inflammation it set up, caused severe pain in the stomach, frequent vomiting, and loss of flesh, and together with injury done to the bowels by some fragments of the knives that passed into them, eventually destroyed life; but, from the first, it seems not to have excited much fever or any marked disturbance of the nervous system. The knives were swallowed on the 5th and 6th of December, 1805, and the man lived between three and four years, afterwards—till March 1809. It is stated that towards the close of January, 1806—that is, in less than two months after he swallowed the knives,—he moved about and at intervals performed the duty of a sweeper; and that in the course of the following autumn, though still having pain in the stomach when standing erect, and occasional vomiting, he gathered strength and flesh, ate and drank voraciously, and performed various easy duties in his ship.[1]

Another case, which is historically interesting, and still instructive on the point before us, is that of the man who swallowed molten lead during the fire which consumed the Eddystone Lighthouse, near Plymouth, in the winter of 1755. This man, Henry Hall, who was 94 years of age, but remarkably active for his time of life, had, with two other men, the charge of the Eddystone Lighthouse. About two o'clock in the morning of the 2nd of December, the fire which consumed the lighthouse broke out in the lantern. Hall, who was at the time the only man upon the watch, attempted to extinguish the fire, and, in order to reach it, had to throw water four yards higher than his head. As he was looking upwards to see the direction and success of some water he had thrown, a quantity of molten lead fell in a torrent from the roof upon his head and face and over his clothes, and part of it made its way through his shirt-collar and very much burnt his neck and shoulders. From that moment he had a violent internal sensation, and imagined that a quantity of the lead had passed down his throat into his body. As the rage of the flames increased, he, with his companions, had to retire downwards, from room to room; and at ten o'clock, after the fire had been burning eight hours, some boatmen, who had come to their assistance, found them almost in a state of stupefaction, in a cave on the east side of the rock, to which they had retreated to avoid the falling of the timber, red-hot bolts, &c., upon them. The

[1] An account of this remarkable case, drawn up by Dr. Marcet, is contained in the 12th volume of the "Medico-Chirurgical Transactions." Numerous corroded blades and other fragments of the knives, found in the stomach after death, are preserved in the museum of Guy's Hospital.

boatmen being unable, on account of the surf, to land upon the rock, threw a coil of small rope upon it. The lighthouse men laid hold of the rope, and having fastened it, one by one, round their waists, jumped into the sea and were towed into the boat. They were immediately taken by sea to Plymouth, a distance of about fourteen miles, where Hall was attended by Dr. Spry. He invariably told Dr. Spry (who constantly administered the proper remedies to such burns and hurts as could be perceived) that if he would do anything effectual towards his recovery he must relieve his stomach from the lead which he was sure was within him; and this he not only told Dr. Spry, but those about him, though in a very hoarse voice; and he also said the same thing to Mr. Jessop (the surveyor,) who went to see him several times during his illness. The reality of the assertion seemed, however, then incredible to Dr. Spry, who could scarcely suppose it possible that any human being could exist after receiving molten lead into the stomach, much less that he should afterwards be able to bear towing through the sea from the rock, and also the fatigue and inconvenience from the length of time he was in getting on shore before any remedies could be applied. The man did not show any symptoms, however, of being either much worse or of amendment till the sixth day after the accident, when he was thought to be better. He constantly took his medicines, and swallowed many things, both liquid and solid, till the tenth or eleventh day, after which he suddenly grew worse; and on the twelfth day, being seized with cold sweats and spasms, he soon afterwards expired.

The following is the account given by Dr. Spry of the condition of the stomach:—

"Examining the body, and making an incision through the left abdomen, I found the diaphragmatic upper mouth of the stomach greatly inflamed and ulcerated and the tunica in the lower part of the stomach burnt; and from the great cavity of it took out a great piece of lead," weighing 7 oz. 5 drs. 8 grs.

On the 19th of December, 1755, Dr. Spry transmitted an account of the case to the Royal Society; "but that learned body thinking the circumstance very unlikely and extraordinary, and doubting the truth of it, the reading of the paper was deferred until a further elucidation was received."

Dr. Spry, when his word was thus doubted, made various experiments on dogs and fowls, for the sake of re-establishing his character for veracity.

He poured molten lead, by means of a funnel, down the throat of a small dog which had eaten nothing for twenty-four hours, and kept the dog afterwards without food or drink. The next day the dog was very brisk, and, on being killed, six drachms and one scruple of lead were found in its stomach. The stomach, Dr. Spry says, was much corrugated, but its internal coat was not excoriated.

In another experiment he gave a large dog half-a-pint of milk, and very soon afterwards poured, in the same way, molten lead down its throat. Very soon after swallowing the lead, the dog, according to Dr. Spry, ate freely of milk, as if nothing ailed him; and continued to do so daily for three days, when it was killed, being at that time very lively. Six ounces and two drachms of lead were taken from the stomach. "The pharynx and cardiac orifice of the stomach were a little inflamed and excoriated, but the œsophagus and stomach seemed in no manner affected."

Dr. Spry performed similar experiments on fowls, with a like result.

Having transmitted to the President of the Royal Society an account of these experiments, and having offered further to establish, by the oaths of himself and others, the truth of the facts stated in his paper, the paper was read to the Society, and afterwards published in the Society's "Transactions."

A few years ago these experiments of Dr. Spry were confirmed by other experiments made in France by M. Bretonneau.

In one of M. Bretonneau's experiments, three ounces of boiling water were poured into the stomach of a young dog. The dog immediately uttered frightful cries and vomited violently several times. The next day it appeared languid and oppressed, drank with avidity, but refused food. The third day convalescence commenced, and made progress up to the seventh day, when the dog was killed. The evening before its death, it caressed its master and rolled at his feet in play. When the body was opened, the mucous membrane, the underlying cellular tissue, and, over a large space, the muscular coat of the stomach, were found in a state of gangrene.

In another experiment, four dogs had, each of them, eight ounces of boiling water injected into the stomach in such a way as not to injure the œsophagus. Three days afterwards, they played together and snatched from each other food that was thrown them. They were then killed; and, in their stomachs, were marks of injury like those observed in the former experiment.

Among the stores of medical literature, there are also many re-

markable cases in which great destruction of the lining membrane of the stomach resulted from poisoning by the mineral acids; and in which, although life continued many days, or even weeks, after the acid was swallowed, no striking disorder of the intellect resulted.

Some years ago, an instance of this kind was brought under my notice by Mr. Miller, of King-street, St. James's, in which entire destruction of the lining membrane of the œsophagus, and charring of a small portion of the lining membrane of the stomach, resulted from swallowing sulphuric acid. In this instance, although a large portion of the lining membrane of the œsophagus, which is now in the museum of the College, was brought up entire, like the finger of a glove, the man lived many months, and at length died from the combined effects of stricture of the œsophagus and tuberculous disease of the lung.

In the "Medical Gazette" for September 11th, 1846, a very remarkable case of this kind is recorded, in which the patient lived twenty-three days after swallowing nitric acid, and in which the lining membrane of the stomach was found after death to be almost entirely destroyed.

Such cases may be classed with the cases I have before related, for the ill effects of strong mineral acids taken into the stomach are mainly due to their local action. The acid chars the tissue with which it comes in contact, coagulates the blood in its minute vessels, and, consequently, while it is sufficiently concentrated to have this chemical effect, although it may continue to permeate the tissues as it would permeate dead membranes, it does not become absorbed into the general mass of circulating blood.

Thus, when severe inflammation of the stomach results from direct, local injury, whether this be caused by mere mechanical irritation or by the action of heat or strong acids, severe local symptoms—commonly excruciating pain and frequent vomiting—result; and, for a time, the heart's action may be much depressed; the depression which immediately follows the injury, or the exhaustion consequent on the inability to eat or digest, may, indeed, destroy life; but there is not, necessarily, any high degree of fever or any serious disorder of the functions of the brain.

These cases confirm, then, the conclusion we had before arrived at,—viz., that slight inflammation of the stomach, resulting from the irritation of undigested food or from excessive or unseasonable indulgence in alcoholic drinks or from the ill-advised use of irritating

drugs, excites but little constitutional disorder, and, from the slightness of this disorder and the power of rapid recovery which the stomach possesses, is but little heeded and often overlooked.

The effects of any injury to the stomach must depend very much on the previous state of the stomach and of the nervous system, and on the muscular power of the heart. An injury of the stomach which in one person would do no harm, in another may cause terrible irritability of the stomach or excessive pain and collapse, just as an injury of the hand or foot, which in one person has no serious result, in another causes agonizing pain, or the fatal spasms of tetanus.

Many instances are on record in which a person previously in good health has died very speedily and unexpectedly after a gluttonous meal of some indigestible substance, and apparently in consequence of the pain which the over-distention and irritation of the stomach occasioned. In such instances, the immediate cause of death is faintness or stoppage of the heart's action, under the influence of the pain: and I believe that in most of them the heart was previously unsound, or the power to bear up under pain or other depressing sensations had been weakened by intemperate habits.

LECTURE V.

Inflammation of the stomach—continued.

THE mucous membrane of the stomach may be fretted and inflamed by various conditions besides excesses in eating or drinking and the swallowing of substances which are hard of digestion or which exert an injurious chemical action upon it. Among these conditions may be ranked severe or long-continued abstinence. The stomach is an organ whose action, like the actions of the voluntary muscles and the brain, is destined to be intermittent; and when the digestive power is exhausted, a certain period of abstinence, or rest, is required in order to restore it. The first effect of abstinence is, then, to strengthen the stomach and enable it to digest a greater quantity of food; but if the abstinence be complete and exceed a certain limit, the nutrition of the mucous membrane becomes impaired: digestion then grows feeble, and changes

in the texture of the membrane take place, which, in appearance at least, are very like those which inflammation produces.

This fact, which has been indistinctly perceived since the time of Hunter, was noticed a few years ago by MM. Andral and Gavarret during a course of experiments to ascertain the influence of various conditions on the composition of the blood. M. Andral says:—

"In some experiments which I undertook with M. Gavarret for the purpose of determining the composition of the blood in animals deprived of food, one circumstance particularly struck me,—namely, a notable augmentation in the proportion of the fibrin. My astonishment ceased when, on opening the bodies of these animals, I found in their stomachs evident signs of inflammation, such as bright redness, softening, and numerous ulcerations of the mucous membrane."

He then gives the following details of one of the experiments in question:—Three dogs, in good health, were bled on the same day, the 21st of December, 1841, in order to ascertain the composition of their blood, and were then subjected to different degrees of abstinence until they died.

The first was entirely deprived of food and drink, and lived twenty-one days. Some blood was drawn for analysis, at the end of the first week, and again at the end of the second week, and it was found that the fibrin had increased in the intervals of the successive bleedings from 2·3 parts in 1000 to 3·9 and 4·5 parts.

The second dog was deprived of food, but allowed to drink water, and lived twenty-five days. Like the former, it was bled at the end of the first and second weeks, and the proportion of fibrin was found to have increased in the intervals of the bleedings from 2·2 parts to 2·9 and 4·0 parts.

The third dog was allowed a small quantity of soup every morning, and lived thirty-three days. Blood drawn at the end of the first and second weeks had very little more fibrin than that drawn at the commencement of the experiment, but, at the end of the third week, when some blood was again taken, the fibrin was found to have increased from 1·6 parts to 3·3 parts.

M. Andral says that this dog, which was not completely deprived of food, was the only one in which the stomach was not ulcerated, and that in it the redness of the mucous membrane of the stomach was less general and less vivid than in the others.

The last instance shows, that even a small quantity of food, if

it contain all the elements requisite for nutrition, may protect the stomach and prevent those destructive changes which total abstinence causes; and this accords with the well-known fact, that persons who, from a scanty diet, are much wasted, can sometimes, like persons wasted by fever, digest great quantities of food.

The case is very different if a person be long restricted to food, which, whatever be its quantity, is not sufficiently varied for healthy nutrition. If such a diet be persisted in beyond a certain time, the nutrition of the mucous membrane of the stomach is impaired as by total abstinence, and, in consequence, the appetite fails and digestion is greatly enfeebled.

This was well shown by experiments first performed by Magendie, and subsequently repeated and varied by a Committee appointed by the French Institute with Magendie at its head, to determine the nutritive properties of different kinds of food. The experiments proved that dogs kept exclusively on water, with the addition of oil, sugar, fat, or even of albumen, fibrin, or gelatine, in their pure state, soon die of starvation, just as when kept on water only.

The subject is further illustrated by the disorders of health that have been observed to occur in prisoners kept on a diet of bread and water.

A good account of these disorders has been given by Mr. Malcolmson, in a letter he addressed, in 1837, to Sir Henry (now Lord) Hardinge, on the effects of solitary confinement and a bread and water diet on the health of prisoners in India. He says, "Many men, particularly those of indolent habits, endure a confinement of four or six weeks on bread and water without injury to their health; but in some instances, a shorter period *is sufficient to cause a total loss of appetite; the bread is hardly touched, and on other food being allowed, the patient is unable to eat or digest it.* The stomach becomes weak; there is uneasiness across the stomach, spleen, and liver; the latter is torpid. The bowels are confined, or they are relaxed, with slimy discharges, unaccompanied with pain; yet the swollen red tongue indicates the existence of irritation of the mucous membrane of the digestive canal. The pulse is quick and feeble; and the clammy skin, vertigo, debility, headache, and sleeplessness, show how much the constitution suffers from diminished nervous power. The convalescence is slow, and the treatment requires to be adapted to the enfeebled state of the system."

It appears, from the instances given by Mr. Malcolmson, that when a man is long kept on such a diet, the health is irretrievably

ruined: the subsequent allowance of food sufficient for the maintenance of health does not restore him.

These observations of Mr. Malcolmson are confirmed by the early Reports of the Inspectors of Prisons.

The irreparable injury to the health produced by long continuance on a diet deficient in some of the principles requisite for nutrition is also well shown in the curious and painful history of Dr. Stark, who, in 1769, when he was pursuing his medical studies at St. George's Hospital, heroically made himself the subject of experiment.

His experiments were commenced on the 12th of June; and, from this time until the 26th of July,—that is for more than six weeks,—he lived on bread and water only; increasing from time to time the daily allowance of bread from twenty ounces, which he took at first, to thirty-eight ounces. For the next fortnight—from the 26th of July to the 9th of August—he varied the diet by subtracting, first four, and then eight ounces, from the thirty-eight ounces of bread, and adding an equal quantity of sugar.

The person upon whom these experiments were made was, to use his own words, "a healthy man, about twenty-nine years of age, six feet high, stoutly made, but not corpulent, of a florid complexion, with red hair."

Once, during the course of these experiments, he yielded to his craving for food of other kind, and ate four ounces of meat, and drank two or three glasses of wine; but otherwise he adhered rigidly to the diet. On the 9th of August, that is, at the end of eight weeks and two days, he was only 2 lbs. less in weight than when he commenced his experiments, but scurvy was making its appearance. The entries made in his journal about this time show that the nutrition of the lining membrane of the stomach and bowels had become greatly impaired. He states, on different occasions, that he had little appetite,—that he ate the latter part of the allowance of sugar with great abhorrence,—that he had pains in the bowels, and frequent liquid stools, which contained some clear, gelatinous substance.

His experiments were pursued, with some slight variation, and the scorbutic symptoms made progress. Subsequently, there occurs the following entry in his journal:—

"On the 8th of September, I was so weak and low that I almost fainted in walking across my room. Had four or five loose stools in the course of the day; was sick; and my tongue was foul."

The experiments were still continued, and the narrative goes on till the month of February, when the Doctor, reduced to the most deplorable condition, fell a victim to his love of science.

It will be seen, that in Dr. Stark, as in the prisoners that fell under the observation of Mr. Malcolmson, the loss of appetite and enfeebled digestion that resulted from the defective diet were attended by frequent slimy discharges from the bowels. A similar disorder of the bowels was noticed by Magendie in his experiments on dogs, and continually recurs in the early Reports of the Inspectors of Prisons. The insufficient diet leads, in the bowels as in the stomach, to impaired nutrition, and often to an inflammatory state of the mucous membrane.

Happily, severe disorders of the digestive organs, resulting from insufficient food, are, in this country, extremely rare; but it is probable that there is some truth in the popular notion, that in persons whose digestion is weak the stomach is frequently injured by too long fasting. It has often seemed to me that a rigid diet, too long persisted in, in the early stage of continued fever, has been productive of much mischief in this way.

Inflammation of the mucous membrane of the stomach may be excited in another way still—namely, by some noxious matter in the blood.

This has been strikingly shown by experiments that have been made on the lower animals for the sake of ascertaining the effects of arsenic. Mr. (now Sir Benjamin) Brodie, in a paper on this subject published in the "Philosophical Transactions" for 1812, says:—

"Mr. Home informed me, that in an experiment made by Mr. Hunter and himself, in which arsenic was applied to a wound in a dog, the animal died in twenty-four hours, and the stomach was found to be considerably inflamed.

"I repeated this experiment several times, taking the precaution always of applying a bandage to prevent the animal licking the wound. The result was, that the inflammation of the stomach was commonly more violent and more immediate than when the poison was administered internally, and that it preceded any appearance of inflammation of the wound." After detailing some of his experiments, Mr. Brodie thus sums up the effects of the poison:—

"These experiments were repeated, and the results, in all essential circumstances, were the same. The symptoms produced were,—

1. Paralysis of the hind legs, and afterwards of the other parts of the body: convulsions; dilatation of the pupils of the eyes; insensibility; all of which indicate disturbance of the functions of the brain. 2. A feeble, slow, intermitting pulse, indicating disturbance of the functions of the heart. . . . . 3. Pain in the region of the abdomen; preternatural secretion of mucus from the alimentary canal; sickness and vomiting in those animals which are capable of vomiting;—symptoms which arise from the action of the poison on the stomach and intestines."

The following is the account he gives of the appearances observed on dissection:—

In animals killed by arsenic, the blood is usually found fluid in the heart and vessels after death; but otherwise, all the morbid appearances met with on dissection are confined to the stomach and intestines. . . . . .

"In many cases where death takes place, there is only a very slight degree of inflammation of the alimentary canal; in other cases, the inflammation is considerable. It generally begins very soon after the poison is administered, and appears greater or less according to the time which elapses before the animal dies. Under the same circumstances, it is less in graminivorous than in carnivorous animals. The inflammation is greatest in the stomach; but it usually extends also over the whole intestine. I have never observed inflammation of the œsophagus. The inflammation is greater in degree, and more speedy in taking place, when arsenic is applied to a wound, than when it is taken into the stomach. The inflamed parts are in general universally red; at other times they are red only in spots. The principal vessels leading to the stomach and intestines are turgid with blood; but the inflammation is usually confined to the mucous membrane of these viscera, which assumes a florid red colour, becomes soft and pulpy, and is separable without much difficulty from the cellular coat, which has its natural appearance. In some instances, there are small spots of extravasated blood on the inner surface of the mucous membrane, or between it and the cellular coat, and this occurs independently of vomiting. I have never, in any of my experiments, found ulceration or sloughing of the stomach or intestine; but, if the animal survives for a certain length of time after the inflammation has begun, it is reasonable to conclude it may terminate in one or other of these ways."

In another paragraph, he says:—

"The inflammation from arsenic, occupying in general the whole

of the stomach and intestine, is more extensive than that from any other poison with which I am acquainted. It does not affect the pharynx or œsophagus, and this circumstance distinguishes it from the inflammation which is occasioned by the actual contact of irritating applications."

These experiments of Sir B. Brodie have been repeated by others with the same results, and have been further confirmed by numerous cases in which arsenic applied to a sore, or to a large surface even of sound skin, or inhaled in the form of vapour, has proved fatal in man. In such cases, unless death occur early from the action of the poison on the nervous system or the heart, pain in the belly, with vomiting and the discharge of mucus from the bowels, almost always comes on; and after death, marks of extensive inflammation of the mucous membrane of the stomach and intestines exist.

It seems probable that this inflammation results from some of the poison being eliminated at the mucous membrane of the stomach and intestines—a membrane which must be regarded, not as a mere lining of the tube, as the mucous membrane of the œsophagus is, but, also, as an expanded gland, destined to furnish abundant secretions, and, by virtue of its active secreting power, occasionally instrumental in eliminating noxious principles from the blood.

Many other substances, when absorbed into the blood from the surface of the body, have, like arsenic, an especial action on the stomach and intestines. Jalap, for example, purges, and lead excites colic, when applied to a wound. There can be little doubt that some of the noxious principles that may be bred in the body act in a like special manner on these organs, and may excite inflammation or functional disorder of them.

When arsenic is given medicinally, it should be given largely diluted, in order that it may exert no direct injurious influence on the stomach; but when this precaution is adopted, it often happens, after the medicine has been taken some time, even in moderate or small doses, that nausea comes on, with pain and a sense of burning heat in the stomach. These symptoms are usually the earliest distinct indications that arsenic has been given in too large quantity, and it is very important to bear in mind that they depend on *inflammation* of the mucous membrane of the stomach. On the occurrence of these symptoms, the arsenic should not only be left off, but the patient should be kept on a sparing farinaceous and milk diet. The disorder of the stomach will then quickly subside.

If, after the occurrence of the gastric disorder, the use of the ar-

senic be continued, the sufferings referable to the stomach increase, and an inflammatory state of the bowels likewise comes on, causing griping pains of the belly, with diarrhœa and the discharge of slimy mucus. The inflammation of the stomach and bowels thus excited, seems often not to depend on the direct local action of the arsenic on the coats of the stomach, but on the accumulation of it in the system. The pain in the stomach and nausea seldom come on till the arsenic has been taken for some time; and if, under proper management they subside speedily and the arsenic be then taken again, the disorder in most cases soon recurs.

Whenever inflammation of the stomach is excited by some noxious matter in the blood, which must necessarily be conveyed to every part of the mucous membrane, and be carried in the blood to every other part of the body, we may expect the inflammation, like that which results from the absorption of arsenic, to be more extensive than that caused by the mere outward application of an irritating agent, and to be attended by symptoms of inflammation or irritation of the bowels, and by some disturbance of the functions of other organs, which the inflammation of the stomach itself cannot explain.

The gastric disorder in yellow fever and in cholera, which is attended by great congestion of the stomach and by effusion of fluids from the mucous membrane, which has many characters in common with those states which we designate inflammation, is probably brought on in this way, by the influence of some poison acting through the blood.

Another instance of inflammation of the stomach arising from an unhealthy condition of the blood is that which sometimes occurs in gouty states of the system, when the gout does not fix itself in the limbs or when it suddenly leaves them.

The stomach is more apt to suffer from the sudden retrocession of gout than any other organ; and two kinds of gastric disorder arising in this way have been recognised.

The first and most common kind usually occurs in chronic gout, and is chiefly marked by a feeling of weakness or sinking in the stomach, with griping pain and a sense of cramp. The pain is relieved by pressure, and is seldom attended with vomiting, fever, or other symptoms indicative of active inflammation.

When the disorder has these characters, it is best treated by warm alcoholic stimulants, and by sinapisms, applied for the purpose of recalling the gout to the joints that have been recently or oftenest affected with it.

The second kind of gastric disorder succeeds active inflammatory gout in the joints, and is marked by severe pain in the stomach, a high degree of fever, and frequent vomiting or retching, often attended by profuse diarrhœa. If the disorder be not controlled, the active febrile symptoms are early followed by a state of alarming and sometimes fatal collapse.

This affection of the stomach is, now-a-days, of rare occurrence, and has not been sufficiently studied. There can be little doubt that the disorder is inflammatory, but that, like gout in other parts, it has characters which may serve to distinguish it from common inflammation.

One of the most striking characters of gouty inflammation of the limbs is an abundant effusion of fluid into the synovial capsules, or into the cellular tissue surrounding the inflamed joints. In gouty inflammation of the stomach, an effusion of the same kind sometimes takes place into the cellular tissue under the mucous coat, causing great thickening of the walls of the stomach. In illustration of this I here show you a remarkable preparation which I have found in the museum of the College. It exhibits a considerable portion of the pyloric end of a stomach, the walls of which are enormously thickened by what seems to have been coagulable lymph effused into the cellular tissue under the mucous coat. The preparation was left to the College by Dr. Hooper, and is thus described in his catalogue:—

"*A Portion of an Adult Stomach.*"—There is considerable deposition of albumen between the coats—between the muscular and villous coats. The subject was labouring under acute rheumatic fever, with swelling of all the limbs, which suddenly disappeared, and his stomach seized with pain. He became delirious, and lived two days. Mr. Guthrie's stomach had the same appearance."

What is here termed "acute rheumatic fever" was, in all probability, acute gout affecting a great number of joints at once.

This peculiar form of inflammation of the stomach exemplifies a fact which must ever be borne in mind in the consideration of inflammatory diseases—namely, that the course and character, and, in great measure, the event, of inflammation, in any tissue, depend on the nature of the influence by which the inflammation is caused.

When the gouty disorder of the stomach succeeds active gouty inflammation of the joints, and has itself the characters of active inflammatory disease, the most efficient remedies are leeches, or a blister, applied to the epigastrium; abstinence from all stimulating

food; effervescing potash-water, in small quantities at a time, to allay thirst; and opium, to alleviate the severe pain and to support the action of the heart. In conjunction with these remedies, sinapisms or other stimulants should be used, for the purpose of recalling the gout to the joints which it has recently left.

I have hitherto spoken only of inflammation of the mucous membrane of the stomach.

Another form of inflammation of the stomach is now and then met with, in which coagulable lymph becomes effused into the cellular tissue under the mucous coat, which coagulable lymph, if not soon absorbed, hardens and contracts, forming a dense gristly tissue, binding the mucous membrane to the coats beneath. Inflammation having this result, frequently occurs at the margin of an old ulcer of the stomach, as at that of an old ulcer of the skin; but it often exists also, especially in the neighbourhood of the pylorus, independently of ulceration or any other permanent change of texture in the mucous membrane. In such cases the lymph is generally effused pretty evenly in the entire circumference of the pylorus and leads to the formation of a gristly ring or band, which, by its contraction, permanently narrows or strictures the orifice. This form of disease seldom occurs till near the age of 40, and is, I believe, almost invariably the effect of spirit-drinking. It is usually found in conjunction with marks of adhesive inflammation of the liver, spleen, and other organs, which spirit-drinking so frequently causes.

The inflammation most probably involves the mucous membrane, as well as the cellular tissue beneath; and, at its onset, causes, like other forms of inflammation, pain and tenderness of the stomach, and vomiting. The inflammatory symptoms subside as the mucous membrane recovers; but gradually the lymph in the cellular tissue contracts, and those disorders ensue which a narrowing of the pyloric orifice of the stomach occasions. The food is retained in the stomach longer than it should be; the stomach consequently grows larger, and the patient has an unusual facility of vomiting. Some years ago, I made a *post-mortem* examination of a gentleman who died of granular disease of the kidney, in whom narrowing of the pyloric orifice of the stomach, from adhesive inflammation of the cellular tissue, likewise existed. The only indication of this latter disease was an extraordinary facility of vomiting, which he had long had. He could empty his stomach almost when he pleased; but he sometimes vomited involuntarily, especially after having indulged more than usual in eating and drinking; and, on such occasions, it almost

invariably happened that the liquids he had taken were rejected, while the solids were retained.

When the narrowing of the orifice is greater, and the action of the muscular fibres near the pylorus is impeded, the stomach seldom completely empties itself, and the acid residue of digestion in it ferments, causing heartburn, sour eructations, and flatulence, and now and then excites inflammation of the mucous membrane. The stomach continues to grow larger, and, as its capacity augments, the vomiting may become less frequent, but more is thrown up at a time, and at length the disease destroys life by impeding the passage of the food into the intestine.

The same symptoms of obstruction are produced by cancer of the pylorus, which occurs at the same age, and from which the disease we are considering is distinguished by its slower progress; by the absence of hemorrhage, which frequently occurs in cancer; by the absence of any perceptible tumour; and by the circumstance, that it occurs almost exclusively in spirit-drinkers.

In some cases, the disease, instead of being limited to the pylorus, extends some distance in front of it, and the morbid changes, as well as the symptoms, are very difficult to distinguish from those of cancer.

During the inflammatory process, the disease, like adhesive inflammation of the liver, is probably much under the influence of treatment. Leeches, and blisters, and diet, would lessen the inflammatory action, and no doubt favour the absorption of the effused lymph. When the inflammatory process is over, and the lymph has become hard and contracted, the treatment can only be palliative. The evils resulting from undue acidity and flatulence may be mitigated by remedies suited to these conditions: vomiting and other gastric disorder may be lessened by proper regulation of the diet: but the most important point is, to make the patient give up his habit of drinking, and thus to prevent recurrence of the inflammation and other addition to the mischief already done than that which time of itself brings.

In the *treatment* of inflammation of the mucous membrane of the stomach, the fundamental point is to give the stomach sufficient intervals of rest and to avoid irritating it by physic or food. For inflammation brought on by alcoholic drinks or by undigested or irritating food, nothing more is generally necessary than cooling drinks and restriction for a few days to a sparing diet, consisting of light broths, farinaceous substances, and milk. If the inflamma-

tion be very severe, causing much pain and tenderness, with a sense of heat at the stomach and frequent vomiting on the contact of food, leeches may be applied to the epigastrium; the stomach may be cooled, and its irritability much lessened, by sipping from time to time iced water, or by holding pieces of ice in the mouth and swallowing the water as the ice dissolves; and the diet may be still further restricted. Broths may be interdicted, and, for a few days, nothing more be allowed than the simplest drinks and those farinaceous substances that are principally composed of starch. In active inflammation of the entire stomach, or when, from any cause, the digestive power is very feeble, there is usually dislike of animal food, and, by a natural instinct, arrowroot, gruel, etc., are substituted for it. Even farinaceous substances, when they contain much gluten, are found to be heavy and oppressive. The peculiar business of the stomach is to dissolve the albuminous constituents of the food. The gastric juice has comparatively little action on the starch, which, consequently, taxes the stomach less, most probably passes out of the stomach more quickly, and is certainly found, when the digestive power is suspended, to be less oppressive to it. As I have before observed, the restoration of the stomach to its healthy condition is greatly promoted by the active nutrition of its lining membrane.

It may here be not an unfitting place to speak of an appearance of the inner surface of the stomach, to which attention was, I believe, first called by M. Louis, who described it as the "*état mammelonné*," "the mammillated state," of the mucous membrane. The mucous membrane in some parts of the stomach, instead of having an even velvety surface, presents prominences not unlike the granulations of a wound, separated by superficial furrows.

The mucous membrane which exhibits this mammillated appearance varies in colour in different cases, being sometimes rosy, but more commonly grayish. It is always manifestly thickened, and is usually covered by a thicker layer of mucus, and by more viscid mucus than other portions of the stomach. By some pathologists the mammillated state has been ascribed to contraction of the muscular fibres of the stomach. The muscular fibres of the stomach, as of other parts, contract after death by the *rigor mortis*, and contract in greater degree than the mucous membrane. The tendency of this contraction must be to throw the mucous membrane into folds, or, if the mucous membrane be adherent along certain lines to the tissues beneath, to raise or throw out the intermediate spaces,

and thus, if the adherent lines be fitly placed, to produce prominences like those in question.

But it was rightly remarked by M. Louis, that the mammillated appearance of the stomach cannot be attributed to contraction of the muscular fibres, because it is often found in stomachs which are considerably distended, and sometimes does not exist at all when the stomach is much contracted. It really depends on actual thickening of the mucous membrane at the projecting spots, and this may arise from various causes.

It sometimes arises from mere increased secretion, or retained secretion; and in that case, by strong pressure of the finger, the retained mucus may be squeezed out, and the mammillated appearance be destroyed. The appearance is most common in those parts of the stomach where the mucous membrane is thickest, and furnishes the most viscid mucus. In the big end of the stomach, where the membrane is thinner and its secretion more liquid, it is less frequently seen, and, when it does exist there, is less in degree.

It is sometimes found, as a consequence of retained secretion, in persons who had fasted for some hours before death.

In persons who die speedily of malignant cholera, where the stomach pours out in extraordinary abundance a gruel-like fluid, the mucous membrane in a large portion of the organ always presents in a striking degree this mammillated appearance. By pressure between the fingers, a thick, gruelly fluid may be squeezed out, and the membrane be at once rendered smooth and even.

The appearance is also often seen in persons dead of yellow fever, which resembles cholera in being attended by an abundant secretion from the mucous membrane of the stomach.

The mammillated state was attributed by M. Louis to inflammation of the mucous membrane, and may doubtless result from the thickening of the mucous membrane which inflammation causes; but it may equally arise from any other vital process which increases the secreting activity of the cells and favours the retention of the secreted fluids within them. That it is not generally a serious pathological change is sufficiently shown by the observation of M. Louis himself—that often it is not denoted by any symptoms of gastric disturbance, and that it is always found in conjunction with some other disease. Another circumstance which shows that it cannot be considered in all cases a morbid state is, that it is sometimes found in persons killed by accident in the midst of health.

On the 15th of May, 1846, at eleven, A. M., a robust labourer fell

from a scaffolding at the British Museum, and fractured several of his ribs. He was taken to King's College Hospital, where he died about an hour after the accident. The following day, twenty-six hours after death, when the body was opened, the stomach was found empty, and the mucous membrane towards the pyloric end was of a grayish colour, thickened, mammillated, and covered with ropy mucus. The mammillated appearance probably resulted here from the circumstance, that death occurred just before the time of the principal meal, and when the stomach had been for some hours empty.

LECTURE VI.

Ulceration of the mucous membrane of the stomach. The perforating or simple ulcer.

I SHALL call your attention to-day to an affection of the stomach, which is often brought under our notice in the hospital, and which has been variously termed *simple* ulcer, or *chronic* ulcer, or *perforating* ulcer, of the stomach. The series of preparations which I have placed on the table afford good illustrations of its various forms and results.

In most cases, the stomach presents no marks of disease, except a single deep ulcer on its inner surface. This ulcer is seldom larger than a shilling, but sometimes, especially when it is situated on the posterior wall of the stomach, grows to the size of a crown-piece, or larger even than this. It is generally circular or oval, and in all cases extends through the mucous membrane, the edges of which are clean-cut, as if a portion of the membrane had been punched out. Sometimes, the mucous membrane only is destroyed, and the ulcer has then an even base, formed of the submucous cellular tissue. In other cases, after a time, the process of ulceration eats through the other coats of the stomach in succession, so that perforation takes place and some of the contents of the stomach escape into the sac of the peritoneum.

The outer coats of the stomach are always destroyed in less extent than the mucous coat, so that, when perforation occurs, the aperture seen from without is much smaller than the corresponding ulcer of the mucous membrane.

At first, and often for a long time after the formation of the ulcer, the coats of the stomach at its margin present no change of structure; but in cases of long standing the margin of the ulcer, like that of an old ulcer of the skin, is frequently hard and thick, from the contraction of lymph that has been effused into the submucous cellular tissue. This hardness and thickening seldom, however, extend more than a line or two from the edge of the ulcer.

It frequently happens that, before all the coats of the stomach are eaten through, adhesive inflammation of the peritoneum over the ulcer is set up, and lymph is poured out, which glues the portion of the stomach covering the ulcer to the pancreas, or to the left lobe of the liver, or to some other organ with which it happens to be in contact. The adhesions formed in this way often prolong the life of the patient by closing the aperture made by the ulcer, and thus preventing extravasation of the contents of the stomach into the peritoneal sac.

When the ulcer extends deeper than the mucous membrane, it frequently opens a branch of one of the arteries with which the stomach is supplied, and thus causes sudden and profuse, and, it may be, fatal hemorrhage.

The ulcer is generally situated along the lesser curvature of the stomach, or near it; usually nearer the pyloric orifice than the cardiac; and much more frequently on the posterior wall of the stomach than on the anterior. It is hardly ever found in the splenic or big end of the stomach, where the softening of the mucous membrane caused by the gastric juice is most apt to occur.

An ulcer is now and then met with in the first or upper part of the duodenum, having precisely the same characters as the simple ulcer of the stomach, and doubtless formed in the same way.

In most cases of simple ulcer of the stomach the ulcer is solitary, and, as I have before observed, the stomach presents no other marks of disease, except such as are clearly traceable to it. Now and then, however, more than one ulcer exists. Of seventy-nine cases collected by Rokitansky the ulcer was solitary in sixty-two. Of the remaining seventeen cases there were twelve in which two ulcers existed; four in which there were three ulcers; and one in which there were five. Of the preparations which I have placed on the table there are three in which two ulcers exist in the same stomach. Now and then an ulcer in the duodenum is found in conjunction with one in the stomach.

A simple ulcer of the stomach is sometimes met with cicatrized.

The ulcer heals just like an ulcer of the skin. The portion of the mucous membrane destroyed is replaced by a dense fibrous tissue, which contracts, and thus draws towards the centre of the ulcer, and consequently puckers, the mucous membrane around it. The newly-formed fibrous tissue has a very different appearance from the mucous membrane of which it takes the place, and never fills up the cavity or depression formed by the ulcer,—so that the scar of the ulcer is readily discernible by the deep permanent depression which is thus left, as well as by the puckering of the mucous membrane around it. If, however, the ulcer be small, its edges may be drawn together and unite, and a mere stellar cicatrice be left, without any permanent depression.

When the ulcer is large and situated across the lesser curvature of the stomach, the process of healing, by the contraction that attends it, often permanently alters the shape of the stomach, diminishing its breadth at that part. This change of shape is very striking in these two preparations from the King's College museum, in each of which the stomach is divided into two pouches, as if by a string passed transversely round it, looping up the greater curvature towards the lesser.

Such are the facts respecting the simple ulcer of the stomach that have been learned from dissection, and from some of these facts—from the circumstance, namely, that the ulcer always extends through the mucous membrane, and that, when first formed, it has always a definite circular or slightly oval shape and clean-cut edges—there can be little doubt that it is formed by *sloughing* of the mucous membrane, and not by a process of ulceration commencing at the surface.

The important question now naturally arises,—Under what circumstances does the ulcer occur, and by what agency is it produced? On these points our knowledge is very defective.

The disease is met with in both sexes, but, as it appears, more frequently in women than in men. In the 79 cases I have before referred to, of which an analysis has been given by Rokitansky, 46 occurred in women, 33 in men. It hardly ever occurs under the age of 16,[1] but is found in persons of all ages from this to 60 and upwards. According to Rokitansky, it is met with more frequently in persons beyond 50 than in persons under 30.

It occurs in the different countries of Europe in which morbid

[1] I have met with but one instance in which it occurred, in a girl, at the age of fourteen and a half.

anatomy is cultivated; in agricultural districts and in large cities; and, though not with equal frequency, in the various classes of society. It seems to be much more frequent, even considering their relative numbers, among the poor than among the rich, and, in this country is generally supposed, and I believe rightly, to be most frequent in the class of maid-servants, between the age of 18 and that of 25. Lastly, the ulcer has not been found in conjunction with, or in sequel to, any other disease, with such frequency as to lead us to conclude that it has any intimate connexion with it.

It is clear that these facts have not yet given us the clue to the real cause of the disease. The circumstance, if it be true, that the disease is more frequent, relatively to their numbers, among the poor than among the rich, and that it is more frequent among unmarried maid-servants than in other classes, would favour the inference, that a state of anæmia disposes to it. But it is almost idle, at present, to speculate further. The observations yet made do not enable us to explain how it is that the ulcer hardly ever occurs under the age of 16; how or why it is that the ulcer is always situated in what has been termed the pyloric division of the stomach or in the first part of the duodenum; how it is, again, that the ulcer is generally single, and that it is so much more frequent along the lesser curvature of the stomach, or near it, than in any other part.

Peculiarities in the structure or function of the pyloric division of the stomach, or some physiological relation between the stomach and other parts not yet suspected, may, by and by, be brought in evidence, and may perhaps furnish satisfactory answers to these important questions. That there are such physiological relations as I have here suggested is rendered extremely probable by the remarkable discovery, made a few years ago by Mr. Curling, that severe burns are frequently followed, at least in young persons, by a sloughing ulcer of the middle portion of the duodenum, which, like the ulcer of the stomach of which I am speaking, frequently destroys life by eating into an artery, and thus causing sudden and profuse hemorrhage, or by leading to fatal perforation.

Waiving, then, any further speculation on the cause of the ulcer, let us turn our attention to its effects and to the circumstances which promote or hinder its healing.

An ulcer in the stomach, however produced, which has extended through the mucous membrane, is clearly very difficult to heal; and when cicatrization does take place, the lost substance is very imperfectly restored, and, unless the ulcer be a very small one, a deep depression, or pit, is left.

The contrast which the stomach presents in this particular with the small and with the large intestine is very striking. The ulcers which form in the small intestine in typhoid fever generally heal in a few weeks, when the force of the fever is past. The ulcers which form in the large intestine in dysentery often heal rapidly, if proper care in diet be taken; and in those cases in which they remain open, or in which some of them remain open, for years, no perforation of the intestine takes place. At the bottom of the ulcer lymph is effused, which becomes firm and resisting, and effectually protects the coats beneath.

Several circumstances conspire to prevent the same thing from happening in the stomach.

The first of these is the great change of volume to which the stomach is liable two or three times a day. Directly after a meal it is full and large, and at the end of three or four hours it is again empty and contracted.

The healing of an ulcer must also be retarded by the constant churning motion that takes place in the stomach during digestion.

Dr. Beaumont observed that, in the stomach of St. Martin, as long as digestion was going on, the food was regularly carried round and round, in from one to three minutes, from left to right along the great curvature of the stomach and from right to left along the lesser curvature.

The sagacity of Hunter had already led him to infer that regular movements take place in the stomach, from the circumstance that in the hair-balls found in the stomachs of cows and some other animals the hairs have a regular direction.

In a state of health, we are happily unconscious of these movements of the stomach, as we are of the stronger contractions and movements of our hearts; but when an ulcer exists in the stomach they must fret its surface, and be an obstacle to its healing.

The process of healing is doubtless hindered also by the mechanical and other irritation of the sore caused by the various substances which are taken as food.

The mucous membrane of the stomach is so organized as to bear with impunity, when healthy, the contact of substances differing widely in their qualities. The stomach is intended to be the common receptacle of the various matters from which the nutriment of the body is derived: and its mucous membrane, with which all these matters are brought into contact, is so organized as not to be in-

jured or painfully affected by them. But when a portion of the mucous membrane is destroyed, the mildest articles of food cause pain—a change of temperature, even, by the drinking of water too hot or too cold, causes pain—and the surface of the sore is constantly fretted, and its healing retarded, by the contact of those substances which are the natural and appropriate stimulus of the mucous membrane.

The healing of an ulcer in the stomach is probably retarded also by the action of the gastric juice. The solvent power of this juice has, indeed, no injurious effect on the living mucous membrane, but it probably dissolves and removes the lymph which is poured out on the bottom of the ulcer, and it is only by means of this plastic lymph that the lost substance can be repaired and the ulcer heal.

All these circumstances explain how it is that a small ulcer, which causes no constitutional disturbance, which may not even much impair the nutrition of the body, and which, if situated in a lower portion of the same canal, might soon heal, becomes so serious a disease,—how it leads so frequently to long-continued suffering and death.

It is now time that we should consider the *symptoms* of ulcer of the stomach and the circumstances by which it may be distinguished from other affections of this organ.

We have already seen that the disease is one of considerable danger—that it may at any time destroy life, almost suddenly, by causing perforation of the stomach or profuse hemorrhage. We have seen, too, that it is a curable disease—that the ulcer, even when of long standing, may heal, and the health of the patient be restored—and there can be no doubt that the healing of the ulcer and the recovery of the patient may be brought about or be much promoted by judicious treatment. The health and life of the patient may depend, then, on our ascertaining the real cause of his ailments.

But, at an early period of the disease it is not easy to do this. We are not aided in detecting the disease by knowledge of its causes or of any peculiar circumstances under which it is apt to arise; and, when the disease is recent, the symptoms are of doubtful character, and often the sufferings of the patient and the derangement of his health are so slight as not to alarm either himself or his friends. Sometimes he follows his usual occupations, and seeks no advice, till perforation of the stomach takes place. He does not even regard himself as an invalid, and is considered by his friends in good health, when he is seized suddenly with agonizing pain at the epi-

gastrium and with the other symptoms of peritonitis from perforation, falls rapidly into collapse, and dies within twenty-four or thirty-six hours.

In such cases, the character of the symptoms—especially the great suffering referred to the stomach and the suddenness with which life is cut short in the midst of apparent health—often lead to a suspicion of poisoning. One instance of this kind, which gave rise to a coroner's inquest, has fallen under my own observation, and many others are related in the systematic works on forensic medicine. A perusal of these works might, indeed, lead to the belief that the symptoms which precede perforation are generally trivial; but such is by no means the case. In a great majority of instances the symptoms are distressing, and, when the disease has lasted some months, they are generally significant enough.

The most constant symptom is pain in the stomach, which is generally referred to a small spot, and is more severe after meals, when the stomach is distended and when its vermicular movements are going on. The pain usually abates as the stomach gets empty, to be renewed again by the next meal. Now and then, however, pain is also felt when the stomach is empty. Together with this pain, there is some degree of tenderness, or soreness, at the epigastrium; but this is often slight, and, like the pain, is generally referred to a small spot. Besides the pain at the epigastrium, pain is very commonly felt in a small space in the corresponding part of the back. There is also occasional eructation of a sour fluid, and now and then, perhaps only once or twice in a month, the patient vomits his food.

The disease causes very little constitutional disturbance. Unless the ulcer be large, there is complete absence of fever and of thirst, the appetite is commonly but little impaired, and the patient does not fall away perceptibly in flesh or in strength.

The pain at the stomach after meals, and the sour eructations, and, it may be, the occasional vomiting, are the only symptoms of disease. These symptoms persist, and the patient may go on for months, heeding them but little, and following his ordinary course of life. At times, however, the pain at the stomach gets more severe, and the vomiting more frequent, and the appetite fails. Now and then there is slight diarrhœa. These exacerbations render a restricted diet necessary; and, under the influence of this, the symptoms soon return to their former degree, and the patient goes on as before.

After a time, the ulcer may begin to heal and the pain of the stomach to abate. The process of healing may go on uninterruptedly and the health be permanently restored; but more generally the amendment is only temporary, and, after an interval of comparative ease, the former pain and uneasiness of the stomach return.

But, as dissection has already disclosed, the ill effects of ulcer of the stomach do not end here: the patient is liable to accidents which may at any moment place his life in jeopardy. The most common of these is profuse hemorrhage, in consequence of the ulcer eating into one of the arteries of the submucous cellular tissue. The hemorrhage is often preceded for a day or two by an increase of pain, which may, perhaps, be taken as evidence that the ulcer is spreading; but, in other cases, it occurs without any aggravation of the usual symptoms.

If the blood be poured out in small quantity, or slowly, it may pass off by the bowel, without causing vomiting. The patient grows rapidly weak and listless, has a slight diarrhœa without tenderness of the belly or fever, and the discharges from the bowels are copious and black. More frequently the blood is poured out in large quantities at a time, and acts as an emetic. The patient has a sense of weight at the epigastrium and a feeling of faintness and nausea, soon succeeded by vomiting of a large quantity—from one to three pints—of black, clotted blood. The vomiting is followed by a state of faintness, and the hemorrhage ceases. Frequently the vomiting recurs on the same or the following day, and a larger quantity of blood is again brought up. Some blood also passes downwards, and the discharges from the bowels are copious and black.

At the end of a day or two the hemorrhage ceases entirely, and the patient is left blanched and weak. In addition to the sufferings which belong properly to the disease of the stomach, he has now those which result from the loss of blood. Slowly, and by degrees, the loss of blood is repaired, and the symptoms directly referable to the stomach alone remain.

In the majority of instances, after the lapse of some months, or, it may be, of two or three years, hemorrhage comes on again. The patient, after a day or two's increase of pain, but sometimes without this and quite suddenly and unexpectedly, is taken, as before, with faintness and nausea, which is followed by vomiting of black clotted blood. The circumstances of the former attack are repeated, and, at the end of a day or two, at most, the hemorrhage again ceases.

The occurrence of hemorrhage is an accident, and may take place

soon after the formation of the ulcer, or years after, or not at all. It may result from a small ulcer, and not from a large one. It has, therefore, no constant relation to the severity of the other symptoms. *When hemorrhage has once occurred it is very apt to occur again.* I have known an abundant hemorrhage do good by inducing an early resort to proper treatment, and by thus preventing a small ulcer from growing large.

In cases which are very protracted—where the ulcer remains open, as it sometimes does, for many years—it happens not unfrequently, that an outpouring of blood, such as I have described, occurs four or five times, at unequal, and, it may be, long intervals. Notwithstanding that the hemorrhage is generally abundant, it seldom proves immediately fatal. Among a large number of cases of this kind that have fallen under my own observation, there have been only two or three in which this happened. In one of these cases, the patient, who was master of the parish school of St. Clement's, lived in the immediate vicinity of the hospital, and a complete history of his illness was taken. Symptoms of ulcer of the stomach first appeared in June, 1842, when he was forty-eight years of age; and from this time till his death, which happened in December, 1844, he was frequently under my care on account of it. He had an abundant hemorrhage from the stomach in October, 1843, which ceased at the end of two or three days, and did not recur till the 20th of December, 1844. On the evening of that day, he grew faint and vomited blood. The loss of blood was not, however, sufficient to prevent his attending his school as usual. On the evening of the 23rd he grew faint again, and felt sick, but did not vomit. He complained of griping pains in the belly, but was not purged. About an hour afterwards he fell down in a fainting fit, and expired.

The stomach and the whole of the intestinal canal down to the descending colon were distended with dark, clotted blood. The ulcer from which the blood came was situated on the posterior wall of the stomach, about two inches to the right of the cardiac orifice, and was as large as half-a-crown. It had destroyed all the coats of the stomach down to the pancreas, which was there adherent to it, and had eaten through a large artery, which I took to be the splenic, from which the hemorrhage doubtless proceeded. Nearer the cardiac orifice was the depressed scar, about the breadth of a shilling, of another ulcer which had healed.

On the table is a preparation showing an ulcer on the posterior

wall of the stomach which caused fatal hemorrhage by eating into the splenic artery; and another preparation showing an ulcer on the lesser curvature which led to the same event by laying open the gastric or coronary artery.

Simple ulcer of the stomach, as I have already remarked, seldom proves fatal by hemorrhage. Cruveilhier states, that, of the cases which he had collected, the only ones that proved fatal in this way were those in which the ulcer had eaten (as in the preparations to which I have just pointed) into the gastric or the splenic artery. These ulcers form most commonly, as we have seen, along the lesser curvature of the stomach or on its posterior wall; so that the gastric artery, which runs along the lesser curvature, and the splenic artery, which crosses the posterior surface, are liable to be involved in the ulcer.

But death results much more frequently from another accident to which persons with this kind of ulcer are liable—namely, *perforation* of the stomach and the escape of its contents into the sac of the peritoneum. When this happens, the patient is seized, suddenly, with agonizing pain at the epigastrium, soon followed by the other symptoms of peritonitis from perforation, and usually dies in from eighteen to thirty hours.

As I have already remarked, the occurrence of death in this sudden way, in a person who, up to the time of the perforation, had been following his usual course of life and had seemed in good health, has often led to a suspicion of poisoning. All the concomitant circumstances have, in consequence, been often noticed and recorded with extreme care and minuteness. Mr. Alfred Taylor, who has published an excellent paper on this subject in its medico-legal relations, (in the fourth volume of Guy's Hospital reports,") states, that the perforation generally occurs soon after a meal. Its more frequent occurrence at that time is, no doubt, chiefly attributable to the distention of the stomach which then exists and to the vermicular movements of its coats which are then taking place; but it may possibly also be owing, in some degree, to the solvent action of the gastric juice. When the ulcer has eaten down to the peritoneal coat, and has, perhaps, impaired the vitality even of this, the gastric juice may exert its solvent action upon it, and immediately cause the catastrophe.

In some cases the process of ulceration is rapid and perforation occurs early, without having been preceded by any severe or alarming symptoms, and within a few weeks (it may be) of the formation

of the ulcer. In other cases the ulcer remains open for many years, giving rise to its ordinary symptoms, and now and then to an alarming hemorrhage; and, at last, leads to the fatal perforation. A remarkable instance of this kind fell under my care in King's College Hospital, in October, 1843. A house-carpenter, sixty-three years of age, who had had the usual symptoms of ulcer of the stomach for fifteen years, was brought into the hospital on the 3rd of October, in a state of extreme exhaustion from vomiting of blood, which came on some days before. The hemorrhage had then ceased, and did not again recur. Two days after his admission to the hospital, perforation of the stomach occurred, and he died twenty hours afterwards. The ulcer, which was not larger than a shilling, was situated on the lesser curvature of the stomach, about half an inch from the pylorus, and had a hard and thickened edge. The rest of the stomach and the intestines throughout were perfectly sound.

Occasionally perforation takes place, but the contents of the stomach are not effused over the whole surface of the peritoneum, so as to excite general peritonitis. The diffusion of the contents of the stomach, and of the consequent inflammation, is prevented by adhesions which have already taken place; and the result is a circumscribed abscess in the sac of the peritoneum, behind the ulcer. One instance of this has fallen under my own notice, and two others are recorded by Dr. Seymour, in a paper published in the "Medical Gazette" for 1844. When this happens, and when the abscess is of considerable size, there is, of course, constant suffering, with loss of appetite and hectic fever, which soon wears out the strength of the patient.

Fatal perforation is, I believe, most common when the ulcer is situated on the anterior wall of the stomach or along its lesser curvature. It would take place much oftener than it does, were it not for adhesions which are apt to form between the peritoneum covering the ulcer and some other organ which this part of the stomach may happen to touch. Before all the coats of the stomach are eaten through, adhesive inflammation is set up in the portion of peritoneum covering the ulcer, and coagulable lymph is poured out, which serves, in some degree of itself, as a safeguard against perforation, and which glues the stomach at this part to the organ with which it happens to be there in contact. By this means the aperture which the process of ulceration would otherwise cause is stopped. The pancreas is, from its situation, the organ by which fatal perforation

is most commonly prevented. The symptoms which denote this partial adhesive inflammation of the peritoneum are an aggravation of pain and of tenderness, (which are still confined to the region of the stomach,) more frequent vomiting, and a certain degree of fever.

It happens now and then, that, without perforation taking place, or at least without extravasation of the contents of the stomach taking place, the adhesive inflammation of the peritoneum set up above the ulcer, instead of being confined to the immediate vicinity of the ulcer and leading to the effusion of only a small quantity of lymph, is much more extensive—lymph is poured out in considerable quantity, the stomach becomes united to all the adjacent viscera, and some coils of intestine, it may be, become united to each other,—so that after the inflammation has subsided, besides the symptoms which properly belong to ulcer of the stomach, the patient is liable to obstruction of the bowels and other evils which result from the natural movements of these organs being restrained.

All this happened to a man from whom the stomach forming this preparation was taken, who died under my care in March, 1845. The stomach was much altered in shape, being lengthened at the expense of its breadth, and was united to all the adjacent organs—the liver, the spleen, the pancreas, the colon—so firmly that it could only be separated from them by dissection. The coils of intestine in the upper half of the belly were glued together in the same way.

The ulcer which was the source of all this mischief was, at the time of death, of the size of a fourpenny piece, nearly circular, and situated midway between the orifices, along the lesser curvature of the stomach. The edges of the ulcer are indurated, and the mucous membrane for some distance around is puckered by the contraction which the ulcer has undergone.

In this instance, death resulted from exhaustion, which was occasioned, not merely by the ulcer in the stomach, but also by the adhesions of the stomach and bowels which resulted from it. These adhesions, by causing obstructions, led to frequent vomiting, and doubtless prevented in other ways the proper action of the digestive organs.

It now and then happens, when the ulcer attains a large size, that death results from exhaustion, without any such extraneous mischief.

When the ulcer is situated near the pylorus and is of large size

or has a thick and hardened edge, the action of the muscular fibres near the pylorus is hindered, and, in addition to the symptoms properly belonging to an ulcer of the stomach, there are those which result from obstruction of the pyloric orifice. The stomach does not completely empty itself, and the residue of digestion in it ferments, causing sour eructations, and flatulent distention of the stomach, which is an additional source of pain. The matters vomited in such cases are often extremely sour, and after death the stomach very commonly contains some muriatic or lactic acid, which dissolves, or *digests*, the mucous membrane in its big end, where the liquids that are in it collect. The same thing happens when an ulcer situated some distance from the pylorus along the lesser curvature, in the process of healing, contracts in a direction transverse to the curvature, and thus loops up the stomach at this part and divides it into two pouches. In that case the pouch at the big end does not completely empty itself; some of the acid residue of digestion remains in it, and the mucous membrane in this portion of the stomach is found dissolved after death. One of the preparations on the table affords a striking illustration of these effects. The stomach is divided into two distinct pouches by the contraction of an ulcer situated on the small curvature of the stomach, midway between the cardiac and pyloric orifices; and the mucous membrane in the left, or cardiac, pouch has been completely destroyed by the action of the gastric juice after death. This peculiar destruction of the coats of the stomach shows that the stomach contained a digesting acid at the time of death, and affords a clue to much of the gastric disorder that exists in such cases.

A remarkable instance of a large simple ulcer of the stomach proving fatal by mere exhaustion has been lately under our observation at the Hospital.

On the 17th of March, Sarah White, a poor woman 56 years of age, was brought into the Hospital in a frightful state of emaciation —the bones almost starting through the skin. She was, of course, extremely feeble, and was, besides, so listless that no connected history of her illness could be taken. As far as could be gathered from her statements, she had always been weakly, but had no serious illness till the preceding autumn—about six months before— when she became troubled with indigestion and occasional vomiting. This continued to increase, and about December she began to suffer very severe pain at the stomach, accompanied with frequent vomiting of what she described as a sour and offensive phlegm. She did

not, she said, reject her food, although she was only able to take it in small quantities at a time, owing to the pain and uneasiness it gave her. In January she had got so weak that she was obliged to take to her bed, and then had a great loathing of food and rapidly fell away in flesh. She continued to vomit sour fluid and occasionally her food, and became very costive—the bowels not being relieved sometimes for a week or a fortnight together, and then never without medicine. She had also offensive eructations, and in the fortnight preceding her admission to the Hospital, several times vomited a matter like coffee-grounds.

When she was brought into the Hospital, her belly was much drawn in—so that the iliac arteries could be readily felt—and between the ensiform cartilage and the umbilicus a firm tumour was noticed, that turned out to be the spine, which was much curved forwards in this region. She had frequent vomiting of coffee-ground matter and eructations of sulphuretted hydrogen. Her loathing of food of all kinds was such that it was with great difficulty she could be made to take any. The little she did eat the stomach retained. She died on the 23rd of March, six days after she was brought to the Hospital.

On examination after death, the stomach was found to be greatly enlarged, so that it reached the pubis and was there in contact with the urinary bladder. It contained a large quantity of dark grumous matter, consisting partly of altered blood. On its posterior surface it was adherent to the transverse colon and to the omentum, and in attempting to detach it from these parts, a large simple ulcer was discovered, which had eaten through all but the peritoneal coat of the stomach. This ulcer, which was situated across the lesser curvature of the stomach, midway between the orifices, was almost a perfect circle, 2½ inches in diameter, and had a clean cut margin, without any induration about it. The liver was somewhat enlarged and fatty, and the gall-bladder contained an oval calculus of cholesterine. There was no other disease of any importance in the body.

From the account I have given of the symptoms and effects of the perforating ulcer of the stomach, it will be seen that the disease becomes more easy of detection the longer it has lasted.

Early in the disease the symptoms are few and equivocal. Pain and soreness at the epigastrium felt after meals, occasional sour eructations, and occasional vomiting—which are often the only

symptoms then present—may result from various other causes, and even from mere functional disorder.

After these symptoms have lasted some weeks or months, their very continuance becomes significant—it renders it highly probable that they depend on organic disease: while the seat of the pain, and the circumstance that it is always increased by eating and usually abates as the stomach gets empty, lead to the inference that this organic disease is in the stomach.

After a time the symptoms I have mentioned are often succeeded by the sudden occurrence of profuse vomiting of blood. When this has happened, the detection of the disease becomes much easier.

Vomiting of blood may, indeed, result from various other conditions; but these may generally be distinguished from ulcer by the nature of the illness and by the circumstances under which it occurs.

1st. Vomiting of blood may result from a general tendency to hemorrhage, in consequence of a general fault of nutrition or a faulty condition of the blood, as in scurvy or purpura; but in such cases the hemorrhage is not confined to the stomach—blood issues from other mucous surfaces, and purpuric spots appear on the skin.

2ndly. Again, vomiting of blood may result, as we have seen, from mechanical congestion of the stomach, in consequence of some impediment to the free passage of the blood through the liver or the chest. In such cases the quantity of blood lost is usually small, and the cause of the hemorrhage is generally obvious enough from the co-existence of other symptoms, which reveal the primary disease, and which show that the passage of the blood through the liver or the chest is greatly impeded.

3rdly. Vomiting of blood sometimes occurs, without any organic disease of the stomach itself, in persons who, in consequence of repeated attacks of ague, or other causes, have great enlargement of the spleen. Here, also, the previous history of the patient, his cachectic condition, and the palpable enlargement of the spleen, readily lead us to the original cause of the hemorrhage.

4thly. Lastly, the hemorrhage may be vicarious of the catamenia; and this is especially liable to happen in young unmarried women,—the class of persons supposed to be most subject to ulcer of the stomach. But, in such cases, the hemorrhage usually occurs at the monthly period, and the natural discharge is suppressed or has previously been irregular; and, if no ulcer of the stomach exist, the vomiting of blood, although it may be attended with se-

vere pain at the time, has not been preceded, and is not followed, by the long-continued pain and soreness produced by ulcer.

In a large proportion, however, of cases even of this periodical vomiting of blood, an ulcer of the stomach does exist, and is the chief, if not the sole, source of the hemorrhage; but the blood, instead of issuing from a vessel of considerable size laid open by the process of ulceration, as in ordinary cases of simple ulcer, oozes from the minute vessels of the raw surface, in consequence of a congestion of the stomach, which takes the place of the appointed monthly congestion of the uterus. Symptoms of ulcer of the stomach are then present in the intervals of the vomitings of blood; and the hemorrhage is traced to a periodical congestion of the stomach only from its occurring at the appointed time, and from its taking the place of the natural monthly courses.

5thly. The vomiting of blood from the simple ulcer of the stomach may also be distinguished from that arising from other conditions by the characters of the blood vomited.

When the hemorrhage consists in a mere oozing of blood, as it does in congestion of the stomach and sometimes in cancer, the blood is coagulated as it escapes, and is vomited in minute clots or shreds. In simple ulcer of the stomach the blood usually issues from a vessel of considerable size laid open by the ulcer; it is poured out rapidly and abundantly, coagulates in a mass, and large clots are often thrown up.

When vomiting of blood does not depend on any of the conditions which I have just mentioned, it results almost invariably (except in the case of malignant fevers) from organic disease of the stomach itself.

When, therefore, profuse vomiting of blood occurs in a person who exhibits no general tendency to hemorrhage; who has no disease of the liver, or in the chest, which greatly impedes the passage of the blood; who has no great enlargement of the spleen; and in whom the hemorrhage cannot, from the time of its occurrence and other circumstances, be referred to disorder of the menstrual function;—we are driven, in reasoning by the method of exclusion, to ascribe it to disease of the stomach itself. When such is the case, and when, moreover, the vomiting of blood has been preceded for some weeks or months by pain and soreness at the stomach, always brought on or increased by meals, hardly a doubt can remain that it actually depends on organic disease of this organ. But, in persons under the age of thirty, the only organic

disease of the stomach that gives rise to profuse hemorrhage, with very few exceptions, is ulcer.

It follows, therefore, that, from the peculiar train of symptoms which I have mentioned,—namely, pain and soreness of the stomach, always brought on or increased by meals, continuing for many weeks or months, with occasional sour eructations and occasional vomiting, but without much fever or constitutional disturbance, and succeeded, at the end of that time, by profuse vomiting of blood,—it follows that from this peculiar train of symptoms, we may occasionally, in persons between eighteen and thirty, infer the existence of ulcer of the stomach with almost as much certainty as that of any inward disease.

In persons above the age of thirty, vomiting of blood, preceded by disordered and painful digestion, may likewise occur from cancer of the stomach. For persons, therefore, who have reached this age, the question will arise,—Is the organic disease of the stomach, which we have inferred to exist, simple ulcer, or is it cancer? When the disease has lasted some months, it is usually not difficult to answer this question.

Cancer of the stomach, in most cases, originates at the pyloric or the cardiac orifice, and in some degree narrows or obstructs it. It also gives rise to a tumour, which, at the end of some months, is generally palpable enough; and it *always* interferes greatly with nutrition, causing progressive, and, after a time, extreme wasting.

Simple ulcer seldom produces any of these effects. When, therefore, from the train of symptoms I have mentioned, we have inferred that organic disease of the stomach exists, we may often proceed a step farther, and conclude that this disease does not obstruct either the cardiac or the pyloric orifice; and from the circumstance that the power of digestion remains and that there is no great wasting, we may conclude, also, that the disease involves only a small portion of the stomach.

We are thus led to the conclusion that there is organic disease of the stomach of such kind as to cause hemorrhage,—that this disease involves only a small portion of the stomach,—that it does not obstruct the orifices,—and that it does not form a tumour large enough to be felt. The probability, in such a case, will be very great, that the disease is simple ulcer, and not cancer. The probability is the greater, the longer the previous duration of the disease. A simple ulcer may continue almost stationary—at any rate, with little change in the symptoms—for twenty years. Cancerous disease, on

the contrary, constantly and steadily progresses; the symptoms become, week after week, more marked; and, although life may be protracted, especially in colloid cancer, for four or five years, the patient generally dies, much emaciated, within twelve months.

If, then, the disease has lasted this time, presenting the peculiar train of symptoms I have mentioned, and there is still no great wasting, and no evidence that the orifices of the stomach are obstructed, and no tumour to be felt, hardly a doubt can remain that the disease is simple ulcer of the stomach. The evidence is as complete and decisive as we can well have for any inward disease. Although, then, it may be difficult, or even impossible, soon after an ulcer of the stomach has formed, to distinguish it from some other diseases, the distinction may generally be made surely enough when the ulcer has existed many months.

It is often possible to go a step further than this, and to form some opinion respecting the *size* and the *site* of the ulcer.

The size of the ulcer may be judged of by the constancy of the pain and the severity of the other symptoms. If the pain be slight and of short duration, and the appetite be good, and vomiting occur seldom, and there be no wasting,—the ulcer is small.

The site of the ulcer is determined by the spot in which the pain is felt. If there be much *tenderness* at the epigastrium, *and no pain in the back*,—the ulcer is most probably on the anterior face of the stomach.

LECTURE VII.

1st. Perforating or simple ulcer of the stomach—Treatment; 2d. Perforating ulcer of the duodenum; 3d. Minute superficial ulcers of the stomach.

We have considered the symptoms and effects of a simple ulcer of the stomach, and the circumstances by which, after it has existed some time, it may generally be distinguished from other diseases.

Supposing the existence of the ulcer to be thus made out, the question arises,—How can we best alleviate the sufferings to which it gives rise, and obviate its dangers, and promote its healing?

We have seen that there are several circumstances which impede the healing of an ulcer in the stomach, and which cause the repair of the lost substance, when healing does take place, to be less perfect there than in lower portions of the alimentary canal. These circumstances are,—the great and frequent changes of volume to

which the stomach is subject; the writhing movements that are constantly going on in its coats while digestion continues; the mass of crude substances that are put into it, which, being constantly driven round and round, must continually irritate and fret the ulcer; and, as regards the ulcer and the secretion from its surface, the irritating and solvent action of the gastric juice. It is by lessening as much as possible the unfavourable influence of these circumstances that the recovery of the patient is best promoted. The chief means of effecting this is by proper regulation of the diet. The patient should prevent the ill effects of distention of the stomach, and, as much as possible, of change of volume of the stomach, by eating little at a time; and the food taken should be of the least irritating kind. Whatever would irritate an ulcer on the skin will irritate an ulcer in the stomach.

Milk, and compounds of milk with farinaceous substances—which would make a soothing poultice for an ulcer of the skin—are the articles of food which are the most soothing, or, rather, which cause the least pain, in ulcer of the stomach, and are, therefore, those on which the patient should mainly subsist. As a diet of this simple kind requires to be persevered in for a considerable time, especially when the ulcer is large or of long standing, care should be taken that the milk is of good quality, and the farinaceous substances given with it should be of the most nutritious kind. Bread, maccaroni, semolina, biscuit-powder, and other substances made of flour; Indian-meal, where there is no repugnance to it; and oatmeal,—are preferable to arrowroot, and those other farinaceous substances which mainly consist of starch. If the milk be good and the farinaceous substances be properly selected, a person may be kept for a long time on such a diet, in conjunction with sugar and tea, without any impairment of strength.

When the irritability of the stomach is not great, finely-mashed potatoes, mashed turnips or carrots, and other soft and well-cooked vegetables, in small quantity, may likewise be given; and there will then be little danger that the general health of the patient will suffer from the restriction of the diet, unless he has previously been of intemperate habits and his nervous system requires the stimulus of alcoholic drinks.

Many persons find that they cannot readily digest milk—that, if they take much of it with their ordinary diet, it lies heavy on the stomach, and causes biliousness and headache. It very seldom happens, however, that milk has this effect when the diet is suffi-

ciently restricted, and when the animal food and fermented drinks commonly consumed by persons in health are excluded from it, and when the milk, instead of being taken alone, is intimately mixed with farinaceous substances. When milk, by itself, is rapidly swallowed in considerable quantity, it is apt to coagulate in the stomach in solid masses, through which the gastric juice does not readily filter, and which are, consequently, hard of digestion; whereas, if it be sipped slowly, or be intimately mixed with farinaceous substances before it is eaten, the casein it contains coagulates in small flakes, which are exposed on every side to the action of the gastric juice, and which are, consequently, soon dissolved.

As the condition of the stomach improves, a little jelly or beef-tea, or the yolk of a soft-boiled egg, may be allowed; and at length, a small quantity of fish, or of tender and easily digested flesh, when this can be taken without inducing pain.

Medicines are of secondary importance to a properly regulated diet.

Where there are sour eructations, or where, in case of vomiting, the matters vomited are very sour,—that is, where the stomach does not completely empty itself or where the irritation of the ulcer causes an outpouring of acid in the empty stomach,—from five to ten grains of trisnitrate of bismuth, suspended in water by means of compound tragacanth powder and syrup, may be given with advantage, two or three times a day, a quarter of an hour before meals, and a dose of magnesia at night. These medicines will tend to prevent undue acidity of the stomach,—the bismuth by lessening the secretion of the mucous membrane, the magnesia by neutralizing any excess of acid when digestion is over—and they do not, of themselves, irritate the surface of an ulcer. For correcting undue acidity, magnesia is, perhaps, better than potash or soda, as the latter medicines, if given in quantity more than enough to neutralize the acid, irritate the ulcer, and have a tendency to occasion hemorrhage from it.

If the stomach be very irritable, the patient may often derive benefit from swallowing now and then a small lump of ice, which will allay the sense of heat in the stomach and render the vomiting less frequent.

When the pain at the stomach is harassing and the nights are restless, much relief may be afforded by opium, which is best given in its crude form and in pills.

When the bowels are much confined, an aloetic, or a compound

colocynth pill should be given. These medicines irritate the stomach less than castor-oil, rhubarb, or the saline purgatives. They exert their chief action on the large intestine, and may generally be given in cases of ulcer of the stomach, without bringing on or increasing the pain. When ulcers exist in the intestines, on the contrary, and a purgative is necessary—as sometimes happens during convalescence from typhoid fever and in dysentery,—the purgative that is safest and best is castor-oil, and of this small doses are then always sufficient. A drachm, or two drachms, will act as surely as two or three times the quantity, and with much less offence to the stomach and much less irritation to the bowels.

In these diseases, as in ulcer of the stomach, great care should be taken in diet until there is reason to believe that the ulcers have healed. Many a case of typhoid fever has terminated fatally, from perforation of the bowel during seeming convalescence, and many a case of dysentery has become chronic, from want of attention to this point. The appetite has been indulged without stint and the raw surface of the ulcers continually fretted.

If vomiting of blood should occur, the means most likely to restrain the hemorrhage are, ice swallowed in small quantity or applied to the epigastrium, rest in the horizontal posture, *prolonged fasting*, and medicines which have an astrigent or styptic action,—such as oil of turpentine, acetate of lead in conjunction with opium, alum, and tannin.

The oil of turpentine, the most efficient, perhaps, of these medicines, was, I believe, first employed as a remedy for hemorrhage in the stomach, by John Hunter, in a case of which he has left the following account:—

"A young man applied a strong solution of corrosive sublimate for the cure of an itching of the pubes; by this application a violent inflammation was produced. I ordered a wash of lime-water, to decompose any part of the sublimate still adhering, and a poultice of oatmeal and lime-water to cover the parts, with tinctura thebaica sprinked over it, which gave him much relief. This was continued two days, when I ordered him the bark, to diminish irritability; but the apothecary chose to give him an emetic first, which brought up a great deal of blood from the stomach, for which Dr. Heberden, who was called in, ordered tincture of roses; but this proved ineffectual. Seeing the patient dying, and well knowing the good effects of turpentine in stopping bleeding externally, I gave him two spoonfuls every two hours of an emulsion made with chio tur-

pentine; cold water clysters being also used. He continued for some time very low, and had scarcely any pulse, having lost so much blood; but he recovered and grew strong and fat."

Of late years the oil of turpentine has been highly spoken of, as a remedy for hemorrhage from the stomach, by Dr. Graves, Dr. Seymour, and other physicians. The turpentine is best given, as recommended by Dr. Graves, in *cold* water, in doses varying from ten to twenty minims, repeated more or less frequently according to the urgency of the symptoms.

It is, however, more effectual where the blood escapes by exhalation from the mucous membrane or from the minute vessels of a raw surface than in cases like those we are considering, where it issues from a vessel of considerable size laid open by the spreading of the ulcer, and where the patient usually gets rapidly faint and brings up *at once* an enormous quantity of black, clotted blood.

After the occurrence of profuse hemorrhage, (and often without this in young unmarried women, who seem to be especially liable to ulcer of the stomach,) a state of great anæmia exists, and, from the irritability of the stomach and the disordered digestion, the reparation of the blood is more than commonly difficult. In such cases, two or three grains of citrate of iron may be given three times a-day, immediately after meals, as soon as food fit for persons in this condition has ceased to cause pain. The citrate of iron does not then irritate the ulcer, and it not only tends to invigorate the body and to remedy the nervous and other disorders which a state of anæmia causes, but most probably, by rendering the nutritive processes more active and healthy, also promotes the healing of the ulcer.

When, in the course of the malady, feverish symptoms arise, with much tenderness at the epigastrium, indicating a spreading of the ulcer or the occurrence of inflammation in the portion of peritoneum above it, the most efficient remedies are, abstinence from food as long as it can be well borne, opium, and rest. We have seen that perforation and hemorrhage are often preceded for a day or two by increased pain and soreness of the stomach. Aggravation of the pain betokens a spreading of the ulcer, and should always be promptly opposed by restricted diet. Prolonged fasting is, doubtless, the most efficient remedy for any aggravation of the symptoms, and the surest means of obviating the danger which such aggravation threatens.

The plan of treatment just described naturally suggests itself when it is clearly seen that an ulcer of the stomach exists; and, in

most of the cases in which it is tried, its good effects are soon apparent. After the patient has been kept for a few days on a diet consisting exclusively of farinaceous substances and milk, the pain has generally much abated, and the vomiting, if any existed, has ceased. Sometimes the amendment is progressive; and, if the plan be persevered in for a few weeks, the ulcer heals, and the patient recovers. In other cases, on the contrary, the pain and soreness, though much lessened, continue to be felt; and, if the ulcer heal at all, it is only after the lapse of many months. As a general rule, the ulcer is slower to heal, the longer it has lasted. Old ulcers are generally larger and deeper than recent ones; and they often have a raised and hard margin, which prevents, or very much retards, the process of healing.

At the hospital I have had positive proof, in several instances, that an ulcer of the stomach has healed under treatment such as I have described. The first instance of the kind I met with occurred six or seven years ago. The patient, who was a labouring man, was long in the hospital with symptoms of ulcer of the stomach, and was an object of much attention. He left the hospital apparently well, and afterwards went to live in the country, where, some time subsequently, he died under the observation of Mr. Tudor, who was a student at the hospital while he was an inmate of it. Mr. Tudor, recollecting the man's former history, had the curiosity to open the body, and found in the stomach the cicatrice of a former ulcer.

Another case occurred in a man named Joseph Marshall, who came to the hospital, five or six years ago, on account of vomiting of blood and other symptoms of ulcer of the stomach. He was kept on a milk and farinaceous diet for many weeks, and the gastric disorder ceased. In the beginning of March, 1851, he became an out-patient of the hospital on account of erysipelas of the head, of which he died. His wife, knowing the interest I had previously taken in the condition of his stomach, informed me of his death. I obtained permission for an examination of the body, which was made by Dr. Beale. The stomach, which is now in the museum of the College, presented in its big end, about two inches from the cardiac orifice, a scar, or rather seam, of an ulcer, which by its contraction had very much puckered the adjacent portion of the mucous membrane.

Another case occurred in the hospital in the winter of 1850. Benjamin Brown, a man sixty-four years of age, who had led a very intemperate life, and drunk great quantities of gin, was admitted

into the hospital on the 28th of October, 1850, with jaundice and ascites, and complaining much of pain in the stomach and vomiting.

He stated that his health was good until six weeks before his admission to the hospital, when he was taken with vomiting, purging, and severe pain in the epigastric region. The pain continued, the stomach rejected almost every thing he ate, and, a fortnight after the commencement of his illness, he vomited more than a pint of dark-coloured, clotted blood. A week after the vomiting of blood, jaundice came on, and he subsequently noticed that his belly was swelled. After his admission to the hospital, the irritability of the stomach abated; but the jaundice persisted, the dropsy increased, and he died from the effects of cirrhosis on the 3rd of January, between nine and ten weeks after his admission to the hospital and nearly four months from the commencement of the gastric symptoms. When the body was opened, two ulcers, freshly skinned over, were found in the stomach. The liver was in a high degree of cirrhosis, and the pylorus was slightly strictured by a narrow ring of white fibrous tissue under the mucous coat. The healing of the ulcers, which must have been impeded by these conditions, was probably due to the strict diet enforced soon after their formation, before their edges had become thick and hard.

In most cases, perhaps, the chief impediment to the cure of these ulcers, when they are not large or of long standing, arises from the difficulty of making the patient submit long enough at a time to the restricted diet that is necessary for it. The pain may not be sufficiently severe, or the general symptoms sufficiently alarming, to furnish an adequate motive for so much self-denial. The ulcers consequently persist until they cause perforation, or until, from their edges having become thick and hard, they are very difficult to heal.

When an ulcer of the stomach has healed, the cicatrice is exposed to be irritated by the food, and by the acids secreted by the stomach and formed from the food, and is apt, after a time, to open again. In that case the symptoms, after having ceased for a time, recur. In some instances in which the ulcer is not large and heals without much difficulty, such an alternation may take place more than once. I presume that this has happened in a poor woman of the name of McCann, who has been lately an inmate of the hospital. In 1851, after having suffered for three weeks pain in the stomach after food, she had sudden and profuse vomiting of blood, and was

brought to the hospital greatly blanched. Under a rigid diet of milk and farinaceous substances the gastric disorder subsided, and she left the hospital well. She continued well for two years when pain in the stomach recurred, soon followed, as before, by profuse vomiting of blood. She was brought to the hospital again, recovered again under the former treatment, and remained well till the middle of January, 1854. The stomach disorder then returned, and on the 1st of March she was brought to the hospital for the third time. Under the influence of diet she soon recovered, as before.

It is almost unnecessary to observe that many of the effects of simple ulcer of the stomach, except perforation and hemorrhage, may result from a fistulous opening into the stomach, caused by the discharge of an hydatid tumour or an abscess of the liver through it. If the tumour or the abscess was large, the opening is generally slow to close up, so that the pain in the stomach after food is of long continuance, and the unnatural adhesions of the stomach at the seat of disease restrain its movements, prevent perhaps its completely emptying itself, and thus give rise to other and more serious disorders of digestion.

An ulcer in the *duodenum* causes less severe and less significant symptoms than an ulcer in the stomach. The duodenum is not liable to the same changes of volume as the stomach, and its contents do not undergo the same churning from the movement of its coats, and the surface of a sore in it is not fretted in the same degree by the crude substances taken as food.

The chief symptom of ulcer in the duodenum is pain in the situation of the ulcer, which is seldom constant, and which, in most cases, is felt only two or three hours after a meal, when the food is passing from the stomach into the duodenum. After this has continued for some time, the ulcer may heal; but occasionally, like a simple ulcer of the stomach, it burrows deeper than the mucous membrane, and eats into an artery in the sub-mucous cellular tissue, causing sudden and profuse hemorrhage, or perforates the bowel, and thus sets up inflammation of the peritoneum that proves speedily fatal.

From the symptoms being usually much less severe than in ulcer of the stomach, the fatal perforation usually occurs with still less warning.

In the summer of 1851, Dr. Johnson brought me the stomach and duodenum of a man who had died very unexpectedly from this

cause. He was a carman, thirty-five years of age, and about eleven o'clock on the 21st of July, left his home, apparently in good health. About an hour afterwards, while talking in the stable, he was seized with agonizing pain in the belly, soon followed by faintness, retching, and other symptoms of peritonitis from perforation of the bowel; and died at four o'clock in the afternoon of the 25th.

On the anterior surface of the upper part of the duodenum was a single perforating ulcer, which on the inside of the bowel was nearly as large as a shilling, and had soft edges. The lining membrane of the stomach was sound.

The man was moderately muscular and well-nourished, and was stated to have enjoyed almost uninterrupted good health. On inquiry it was ascertained that he was occasionally bilious, as was supposed, from drinking beer; and that he sometimes complained of pain at the pit of the stomach, after turning the mangle, but never after eating or at any other time. These trifling ailments were the only discoverable effects of the malady till the fatal perforation occurred.

During the last few years, some striking cases of the same kind have been published in the weekly medical journals. The following instance is recorded in the "Lancet" for the 18th of July, 1846.

A gentleman, who had previously enjoyed excellent and uninterrupted health, had for three days slight uneasiness in the stomach and bowels, which induced him to take a dose of castor oil, but did not prevent his entering fully into his occupations and amusements. On Friday, the 29th of May, he had spent several hours on horseback on the downs of Epsom, and was returning home, when he was seized, at a short distance from Epsom, at six o'clock in the evening, with violent pain in the stomach and bowels, which obliged him to alight and seek a place to lie down. He entered a farm-house, and threw himself on his belly, apparently in great agony, and seeking relief from pressure. Half an hour afterwards he was found by Mr. Stilwell, the surgeon who was called to him, lying on his back on a sofa, in a state of collapse, and complaining of severe pain in the region of the stomach. He was placed in bed, and died there, in the farm-house, the next day, about eighteen hours from the time of his unexpected and terrible seizure. Other interesting particulars of the case, which I have no time to mention, are recorded by Mr. Stilwell. The perforating ulcer was on the anterior surface of the duodenum, near the pylorus.

A case still more impressive, with the details of which some of you are perhaps familiar, occurred in the summer of 1845, and is related by Dr. Little in the "Lancet." I allude to the case of Mr. Somes, the great ship-owner and the late Member of Parliament for Dartmouth, in whom perforation of the duodenum occurred while he was engaged in the House of Commons.

He was a man of firm and vigorous constitution, fifty-seven years of age, and although he seems to have suffered for some time occasional pain at the epigastrium, considered himself in good health. The perforation occurred at a quarter past one, P. M., causing great agony and speedy collapse, which ended in his death shortly after one, P. M., on the following day, just twenty-four hours from the time of his unexpected seizure.

The ulcer, as in former case, was near the pylorus.

I have already alluded to the remarkable discovery made some years ago by Mr. Curling, that a sloughing ulcer sometimes forms in the upper part of the duodenum within a few days after a severe burn, and undoubtedly in consequence of it: and that in such cases the ulcer, like that which is related to the simple ulcer of the stomach, now and then destroys life speedily and unexpectedly by hemorrhage or perforation. This discovery gives a new interest to perforating ulcers of the duodenum, and renders it not improbable that in other cases it may arise from some condition hitherto unsuspected. It is, therefore, desirable that the instances in which it occurs with any unusual complication should be placed on record. The only instance of this sort that I can call to mind as having fallen within my own observation is that of a young woman, Ann Purke, twenty-two years of age, who was brought into the hospital on the 25th of November, 1850, on account of an enormous compound ovarian cyst, which sprang from the right ovary and seemed to have been growing about twelve months. On the 9th of May following there was so much distress from the great distention of the belly and the resulting shortness of breath, that the tumour was tapped, and about a gallon of highly albuminous fluid drawn off. Some relief resulted from the operation, but the poor woman died on the 18th. She was constantly under observation in the hospital from the time of her admission in November, but no particular intestinal disturbance was remarked until the 2nd of May, when a note was made that for a few days preceding she had suffered from vomiting. From that time until her death, vomiting was frequent and distressing, and there was occasional purging.

On examination of the body, the lining membrane of the intestinal canal was found to be sound, except in the duodenum, in which there were two large ragged ulcers. The appearance of the ulcers, as well as the recent occurrence of the intestinal disorder, indicated that the ulcers were of recent formation, and thus raised the suspicion that the tumour had in some way or other been instrumental in causing them.

SMALL SCATTERED ULCERS.

Another kind of ulceration, not unfrequent in the stomach, and of great practical importance, is that which has been described by Cruveilhier and Rokitansky as "hemorrhagic erosions" of the mucous membrane. When the stomach is opened, a number of roundish, dirty-brown or soot-black spots are seen, from the breadth of a pin's-head to that of a small pea, which owe their colour to blood blackened by the acid secretions of the stomach. Sometimes, instead of roundish spots, there are narrow streaks of the same colour. When the minute blood-clot is washed away, there is a slight depression, the result of a superficial ulceration, or "erosion," of the mucous membrane, and the adjacent portion of the mucous membrane is often swollen and soft.

These superficial erosions of the mucous membrane are found in all parts of the stomach, but are most common in the pyloric end; and now and then, with them, erosions of the same character, and having doubtless a similar origin, are found in the upper part of the duodenum.

The erosions are attended by a catarrhal state of the membrane, and the stomach usually contains a considerable quantity of mucus, often mixed with brownish flakes, like coffee grounds, which consist of coagulated and blackened blood.

They form at all ages and in the course of various diseases, but occur especially in active inflammatory diseases, in continued fevers, in persons in whom an impediment exists to the passage of the blood through the liver or the chest, and at the close of lingering diseases, when the power of digestion fails,—in diseases, that is, in which, from a state of fever, or from an impediment to the passage of the blood through the liver or the chest, or from nervous exhaustion, there is a scanty secretion of gastric juice. The "erosions," as I have before remarked, are attended by a catarrhal state of the mucous membrane, and seem to arise from superficial irritation of the membrane by food, when that protection is wanting

which the stomach naturally derives from an active nutrition and a plentiful secretion of gastric juice. They occur not unfrequently in drunkards, and in persons in whom, from any of the conditions I have just mentioned, the natural secretions of the stomach are scanty, and they are occasionally brought on in the course of other diseases by the untimely or excessive use of ardent spirits, of ether, of calomel, corrosive sublimate, or other medicines which have a corrosive action on the mucous membrane.

I have several times had reason to ascribe it to an excessive use of stimulants, given in the hope of remedying the sense of sinking in the last days of life, especially when this has been cut short by cirrhosis or by organic disease of the heart.

Some years ago I met with a rude plate, giving a good general idea of this form of ulceration of the stomach, in a publication called the "Teetotaler's Companion." The plate professed to be a representation of the "ulcerated stomach of a drunkard."

A clue to the explanation of these minute superficial bleeding ulcers is given by the observations of Dr. Beaumont on the effects which excess in eating or drinking had on the stomach of St. Martin.

On the 30th of December, 1832, the stomach of St. Martin was found to be clean and healthy: the gastric juice was pure, and distilled more freely than common. At half-past one, P. M., it was examined again, and found to be empty and clean.

In the afternoon St. Martin became intoxicated, and the condition of the stomach on the following morning is thus described:—

"Dec. 31.—At seven o'clock, A. M., weather cloudy; atmosphere damp and chilly; wind S.; thermometer 30°; temperature of the stomach 100½°; colour darker red than natural, and arid. Mucous coat abraded in spots, and rolled in small shreds; more irritable than usual."

Dr. Beaumont states, as the result of his observations on the subject, that whenever a feverish state existed, or St. Martin had eaten more than the stomach could digest, or had drunk ardent spirits or other intoxicating liquors to excess for some days in succession, the mucous membrane of the stomach lost its smooth and healthy appearance, and its secretions became vitiated and greatly diminished or entirely suppressed.

And he further observes, that, under such circumstances, "there are sometimes found, on the internal coat of the stomach, eruptions, or deep red pimples, not numerous, but distributed here and there

upon the villous membrane, rising above the surface of the mucous coat. These are at first sharp-pointed and red, but frequently become filled with white purulent matter. At other times, irregular, circumscribed red patches, varying in size or extent from half an inch to an inch and a half in circumference, are found on the internal coat. . . . There are also seen, at times, small aphthous crusts in connexion with these red patches. Abrasion of the lining membrane, like the rolling up of the mucous coat into small shreds or strings, leaving the papillæ bare for an indefinite space, is not an uncommon appearance."

We almost seem here to be witnesses of the formation of the minute superficial ulcers, or erosions, in question.

Minute superficial ulcers are apt to form also, more especially in women, when there is some permanent source of irritation elsewhere, deranging the stomach by nervous sympathy. They form, for example, not unfrequently, in women with tuberculous disease of the lung, and occasionally in hysterical or nervous girls with some source of irritation in the uterine system. In such cases it is probable that the immediate cause of the ulceration is still food which the stomach cannot digest. The sympathetic disorder causes waste of power, and so weakness of the stomach: this leads to slow and imperfect digestion: and imperfectly digested food may, by fretting the mucous membrane, give rise to the ulcers in question.

There are probably other conditions, unfavourable to healthy nutrition, which may lead to the formation of these minute ulcers. The singular fact discovered by Mr. Curling, that burns often cause sloughing ulcers of the duodenum, shows, that this portion of the intestinal canal has, with the skin, a physiological relation, of the nature of which we are yet ignorant.

From the cases yet recorded, it would seem that those ulcers result from burns more frequently in children than in grown-up persons,—a circumstance which affords a presumption that the nervous system furnishes the connecting links.

Some years ago, Mr. Simon discovered that bleeding ulcers of the stomach may be caused in cats, irrespective, seemingly, of the nature of their diet, by keeping them for some weeks in close confinement in a dark place. In the spring of 1846, through the kindness of Mr. Simon, I had an opportunity of examining the stomach and duodenum of a cat which had been kept for three weeks in a rabbit-hutch in a dark cellar, and during this time had been fed entirely on cat's-meat and water. The creature was much emaciated,

and the stomach and upper part of the duodenum presented several irregular linear abrasions of the mucous membrane, which were of a dark-brown colour from the presence of altered blood, and resembled the linear hemorrhagic erosions of the human stomach. It is possible, therefore, that confinement, with sufficient light and other conditions unfavourable to nutrition, may occasionally have the same result in man.

These minute superficial ulcers usually cause pain in the stomach after solid food: frequent vomiting, excited by the presence of food; and hemorrhage. The effects are, so far, like those of common simple ulcer; but there are several circumstances which serve to distinguish the two forms of disease.

1. The hemorrhage which results from the minute scattered ulcers consists of an oozing of blood from the capillary vessels of the abraded surface. It occurs as soon as the ulceration takes place, and may continue, day after day, while the ulcers exist, but is usually small in amount at any one time. The hemorrhage in simple ulcer arises from the ulcer eating into one of the vessels of considerable size which run in the cellular tissue under the mucous coat. It usually occurs suddenly, after the other symptoms of simple ulcer have existed for some time, and is profuse; and, where it does not prove fatal, seldom continues more than two or three days.

2. When these superficial ulcers exist there is usually a catarrhal or inflammatory condition of the mucous membrane in great extent, and as a consequence probably of this, there is often a thin white coat on the tongue, and there is a more diffused soreness and much greater irritability of the stomach, and the appetite and power of digestion are very much more impaired, than in cases of simple ulcer, in which the stomach is usually healthy, except at the ulcerated spot. For the same reason, the matter vomited in cases of hemorrhagic erosion often contains much mucus, tinged with blood, which seldom happens in cases of simple ulcer.

3. The two forms of diseases may be further distinguished by the different circumstances in which they respectively occur.

The minute superficial ulcers, like the deep ulcer, may continue long, if the stomach be constantly irritated by food which it cannot digest, or by alcoholic drinks or irritating medicines: they may, perhaps, by such means, be fretted into deep ulcers: but as long as they remain superficial, they may, in most cases, be readily healed, and the stomach be restored to its healthy condition. A few leeches,

or a blister, or the daily application of a large mustard poultice to the epigastrium; the frequent sipping of iced water, which tends greatly to allay the vomiting; and a diet restricted to the lighter farinaceous substances and milk; to be taken cold and in small quantities at a time,—are all the means that are generally necessary. As the stomach becomes less irritable, the diet may be improved; but as long as food has a tendency to cause pain or vomiting, it should be given in the form of pulp, so as not to irritate the stomach mechanically or needlessly tax the power of digestion. Alcoholic stimulants, and aromatics of all kinds, greatly irritate the stomach, and should be strictly forbidden. If, in spite of these means, there be much pain in the stomach, or frequent vomiting excited by food, powdered opium, with small doses of nitrate of silver, in pills, may be given with advantage. Powdered opium is less irritating to a raw surface and has better effect than tincture of opium or the salts of morphia, especially when these salts are given in solution.

If constipation exist in such a degree as to increase the disposition to vomiting or cause unpleasant distention of the belly, it may be remedied by enemas, or, as in cases of perforating ulcer, by an aloetic, or the compound colocynth pill.

When the disorder is thus treated at its first occurrence, the irritability of the stomach in most cases, as I have already stated, soon subsides, unless the digestive power has been much impaired by spirit-drinking, or unless there be any permanent source of irritation elsewhere which has brought on and keeps up the gastric disorder. In such cases the malady may be almost of as long continuance, and be as difficult of cure, as a simple ulcer of moderate size. I have known a disorder, which I have taken to be of this kind, in an hysterical girl, continue for months in spite of the most careful diet—reducing the patient almost to death's door, and leading to the suspicion of incurable organic disease.

LECTURE VIII.

Cancer of the Stomach.

CANCER originates in the stomach more frequently than in any other organ, with the single exception of the uterus.

The organs in which cancer most frequently originates are, the uterus, the stomach, and the female breast. Out of 9118 cases of death from cancer, recorded in the Mortuary Registers of Paris from 1830 to 1840, M. Touchon found that the disease was seated in the uterus in 2996 cases; in the stomach in 2303; and in the breast in 1147;[1] or, taking the proportionate round numbers, in the uterus, in about one-third of the cases; in the stomach, in about one-fourth; and in the breast, in about one-eighth.

The stomach now and then becomes involved in cancerous disease commencing in the subjacent cluster of lymphatic glands; but, almost always, cancer of the stomach is *primary*—that is, the stomach is the part first affected with cancer.

All the principal varieties of cancer—scirrhus, medullary cancer, and areolar or colloid cancer—occur, separately and in combination, in this organ; and the last-named variety, areolar or colloid cancer, though much less common than the other varieties, is more frequent in the stomach than anywhere else.

The different parts of the stomach are not equally liable to cancer. The pyloric end is by far the most frequent seat of it; next after this, perhaps, the cardiac orifice; then, the space along the smaller curvature between the two orifices. The part least liable to cancer, as to the perforating ulcer, is the big or splenic end.

Sometimes the cancer, at the time of death, is of small extent; but occasionally, and especially in colloid cancer, the disease spreads until the greater portion, or even the whole of the stomach, is involved.

When cancer originates at the pyloric ring it spreads towards the big end of the stomach, but not in the opposite direction along the duodenem. This singular circumstance is probably owing in great measure to the closeness of the cellular tissue in the duodenum, which must impede the extension of the disease along it. Cancer does not spread readily along a mucous membrane, except it be through the intervention of the sub-mucous cellular tissue, into which the cancerous matter filters; and if cancer of the stomach has generally a greater superficial extent than cancer of the bowel, it is owing to the greater looseness of the cellular tissue in the stomach, which the extensive and rapid variations in its volume require.

The changes which the stomach undergoes, and the course of the disease, vary with the kind of cancer.

[1] See Walshe "on Cancer," in which this table is given.

Scirrhous or fibrous cancer, which is the most common variety, appears first as a thickening and induration of the sub-mucous cellular tissue, difficult to be distinguished from the thickening and induration caused by the contraction of effused lymph, except by the circumstance, that it is less uniform and that the mucous and muscular coats soon become adherent to the hard tissue between them. From the part first affected, the disease spreads into the cellular tissue beyond, and gradually involves the muscular coat on one side and the mucous coat on the other.

The muscular layer becomes affected early, and in an even, uniform manner. The cancerous matter, which develops itself between the muscular fibres, causes great apparent thickening of the muscular coat, and, if a transverse section of the coats of the stomach be made in the earlier stages of the disease, gives to the cut edge a very peculiar appearance, which is seen in all the varieties of cancer, and which consists of whitish or bluish-white lines perpendicular to the surface of the mucous coat and in striking contrast with the red muscular fibres. After a time, the muscular fibres waste and degenerate—that is, cancer-cells form within their sheaths, and take the place of the original organic constituents of the muscle—and what remains of them gets blended with the surrounding cancerous mass, so that this peculiar appearance is lost.

In sub-mucous cellular tissue the cancerous matter likewise spreads as by infiltration, but much less evenly than in the muscular coat; often forming lobular masses, which project into the cavity of the stomach.

The mucous membrane, from the invasion of the cancer, undergoes various changes, which have been well described by Rokitansky, in nearly the following terms:—

"Sometimes it degenerates into an areolar cancerous tissue, which discharges large quantities of gelatinous fluid: sometimes it is converted into a medullary tissue, and sprouts into fungoid or medullary masses, which suppurate, and thus partially expose the scirrhous cellular tissue; but, most frequently, it becomes the seat of a sloe-black softening, with hemorrhage, and the scirrhous sub-mucous cellular tissue is at length found invested by a thin, gauze-like, black remnant of the mucous membrane, or quite denuded, merely retaining here and there on its surface a few black, convoluted vessels.

"The scirrhus, too, undergoes various metamorphoses. It may, after it has been denuded of the mucous membrane, become gangrenous in large patches, or in round circumscribed spots, the tis-

sue exfoliating by layers, so as to give rise to deep, smooth excavations in the crude cancer; or it may become developed into a more highly organized cancerous growth, such as medullary sarcoma, accompanied by bleeding fungoid tissue; this soon becomes destroyed by a suppurative process, leaving an ulcer which is surrounded by an elevated lardaceous margin."

The diseased mass constitutes a hard irregular tumour, which can often be felt through the walls of the belly.

Medullary cancer, when primary, may originate in the mucous membrane, or in the sub-mucous cellular tissue. The chief points in which it differs, in course and effects, from the varieties of hard cancer, are, that it grows more rapidly, becomes sooner and more widely disseminated, and sprouts into exuberant medullary or fungoid masses, which undergo rapid transformation.

Areolar or colloid cancer appears first as an infiltration of the peculiar jelly-like matter of this variety of cancer into the submucous cellular tissue, and between the muscular fibres and into the interstices of the mucous coat. This infiltration renders the walls of the stomach much thicker than natural, and gives to a section of the muscular coat the striated appearance I just now described. The infiltration into the cellular tissue and between the muscular fibres is very even; but the diseased mucous membrane is apt to sprout here and there into roundish spongy masses, the cells of which are filled by the jelly-like matter. After a time, the exposed surface of these projecting spongy masses wears away; the whole inner surface of the diseased mass becomes eroded; all traces of muscular fibres and of mucous membrane disappear; and the walls of the stomach are converted into a gelatiniform tissue, an inch or two thick, in which no traces of the muscular or of the mucous coat are seen.

The disease, like the other varieties of cancer, is most common at the pyloric end, which it usually encircles evenly. From this end the cancer spreads continuously and evenly towards the splenic end, but it very seldom extends in the opposite direction, along the duodenum. In some cases, the entire stomach is at length involved; but generally death occurs before this happens, and the diseased portion then often terminates abruptly, forming a funnel, of which the pyloric ring is the small aperture. The outer surface of the diseased mass is covered by the peritoneum, and, when the disease has extended far, is roughened by the partial projection of unequal semi-transparent cancerous cells.

Whatever be the kind of cancer, the ulcer resulting from it has seldom, if ever, the repulsive smell which is so common in open cancer of other parts, and which is here doubtless prevented by the antiseptic and solvent action of the gastric juice on the sloughing surface of the sore.

The size of a stomach affected with cancer varies greatly, according to the site and extent of the diseased portion. When the disease is limited to the pyloric end, and, by obstructing or narrowing the pyloric orifice or by preventing the free action of the muscular fibres, greatly impedes the passage of food into the duodenum, the stomach generally gets much enlarged,—in some protracted cases so much so that the pylorus falls into the right iliac fossa and the great curvature of the stomach reaches almost down to the pubis. When, on the contrary, the pyloric orifice is not obstructed or narrowed and a large portion of the body of the stomach is invaded by the cancer, the stomach sometimes becomes much contracted.

In those cases in which the pyloric orifice is obstructed and the stomach has grown large, the muscular fibres of the stomach are hypertrophied, and the mucous membrane in its big end is frequently found much softened or digested after death. This latter change, which gives a clue to the cause of some part of the gastric disorder arises, I need hardly say, from the circumstance that the stomach, in consequence of not readily emptying itself, frequently contains at the time of death some muriatic or lactic acid.

When cancer of the stomach has existed for some time and reached the surface of the organ, the diseased mass often becomes agglutinated to the liver, or to a cluster of enlarged cancerous glands behind it.

The disease frequently proves fatal without extending beyond the stomach; but, like cancer originating elsewhere, it is apt, after a time, to become disseminated, and thus to give rise to secondary cancerous tumours in other parts of the body.

These secondary or remote effects of the disease vary with the kind of cancer.

In medullary cancer, and in scirrhus, the mesenteric glands in the neighbourhood of the primary disease or to which the lymphatics of the stomach run, become first tainted with the cancer, and after a time numerous scattered cancerous tumours form in the liver. This extension of disease is effected by the transfer of cancerous germs from the primary seat of disease through the lympha-

tics and the veins. It seldom happens that the disease becomes disseminated more widely. The wide diffusion of cancer is everywhere effected mainly through the veins, which serve as channels for the transfer of the cancerous germs; but the veins of the stomach all run to the liver, and the cancer-germs conveyed to this organ seem all to be stopped in the plexus of capillary vessels which goes to make up its lobular substance. None of them pass through the liver *with the blood*, to form cancerous tumours in the lungs or other organs. When a further extension of the disease takes place from the liver, it is generally, first to the lymphatic glands to which the lymphatic vessels of the liver run, and thence through the lymphatic vessels up the chest, until the cancerous matter enters the blood, and so becomes diffused over the rest of the body. In the great majority of cases, the local disease of the stomach destroys life before this wide diffusion of the cancer takes place, so that when an opportunity is afforded of examining the body, the only parts affected with cancer are the coats of the stomach, the liver, and the lymphatic glands to which the lymphatic vessels of the stomach or the liver run.

In colloid cancer, dissemination does not take place in the same way. The germs of the disease are too large to be transmitted by the veins, and cancerous tumours do not form in the liver, as in other varieties of cancer. But occasionally small scattered tumours, or even considerable masses of colloid cancer, are found in the omentum and mesentery, and on the intestines, especially near their mesenteric attachment. These small tumours are sometimes under the peritoneum, and spring probably from germs transmitted through the lymphatics; in other cases they grow on the outer surface of the serous membrane, and seem to result from the mere transplantation of germs detached from the surface of the original cancer. Now and then, in cases of cancer of the stomach, the uterus, or ovary, or rectum, is found affected with cancerous disease, which, as these parts are common seats of primary cancer, most probably arose, not from cancer-germs transmitted from the stomach, but from the constitutional disposition to cancer leading to cancerous degeneration of these several organs independently of each other.

In almost all cases, the cancerous disease that co-exists with cancer of the stomach is limited to the abdominal cavity.

Of the *causes* of cancer of the stomach no more is known than of those of cancer of other parts.

An instance is now and then met with in which a tendency to the disease was clearly inherited. I was told a short time ago by a physician now living that he has lost one brother and two sisters of cancer, out of a family of nine. The brother died at sixty-one, from cancer of the stomach; one sister at fifty-seven, also from cancer of the stomach; one sister at fifty, from cancer of the uterus. A few years ago, a man died under my care in the hospital of cancer of the stomach, while I was attending his father out of the hospital with the same disease. The most striking instance of this kind on record is perhaps that of the Napoleon family. The first Emperor Napoleon, his father, and his sister Caroline, are stated to have all died of cancer of the stomach. In the great majority of cases, however, no inherited tendency can be traced—the victim is the first of his family afflicted with cancer.

The disease is rather more common in men than in women, and, like primary cancer of the liver, hardly ever occurs before the age of thirty-five. Cases are indeed now and then met with in which it occurs much earlier in life. I have met with an instance of its occurrence in a woman at the age of twenty-six. A case is related by Andral in which a woman died of it at the age of twenty-two, and in which the disease seems to have begun before the age of twenty; but such instances are extremely rare. In nine cases out of ten,—probably in a much larger proportion,—it comes on after the age of thirty-five.

The disease occurs in all classes of society, from the emperor to the beggar; in the sober as well as in the dissipated; in people who live in the country, as well as in those who live in towns. Indeed, no habits or conditions of life have as yet been shown to have any powerful influence in bringing it on.

The *symptoms* of cancer of the stomach have seldom any characters that are peculiar or especially significant, until the disease has existed a considerable time.

The first complaint is generally of a dull pain, or a sense of uneasiness at the pit of the stomach, which comes on gradually, without fever or other illness, and is always aggravated by taking food. This pain or uneasiness is attended with impairment of appetite, and with flatulence, heartburn, and other results of disordered digestion.

As the disease makes progress, the disorder of digestion increases. The patient usually loses all relish for food, is troubled with occa-

sional eructation of a sour fluid, occurring at various hours of the day, and now and then, soon after meals, brings up, in the same manner, small quantities of food. He loses flesh, and in most cases becomes much depressed in spirits. Still he is free from fever; the pulse is no quicker than it should be; the tongue is clean or only slightly furred; and there is no unnatural heat of skin, and no thirst.

The uneasiness at the epigastrium and the disorder of digestion continue, but the symptoms vary in some degree according to the seat and extent of the disease. When the cancer involves the body of the stomach and the orifices are unobstructed, vomiting, if it occur at all, occurs soon after meals, and what is brought up at a time is moderate in quantity, and consists of the secretions of the stomach and the food, or portions of the food, recently swallowed.

When, as happens much more frequently, the disease is confined to the pyloric end of the stomach, the pyloric orifice usually becomes obstructed or narrowed, or the passage of the food through it is impeded by the restrained action of the muscular fibres. In such cases vomiting is a necessary result, but it takes place later after meals than in the former class of cases, more is brought up at a time, and the matters vomited are very sour.

Several conditions,—undue retention of the food, a scanty supply of gastric juice, and the presence of unhealthy and decomposing secretions furnished by the cancerous surface,—conspire to promote in the contents of the stomach some unnatural fermentation, which leads to the formation of enormous quantities of acid, and often to an abundant evolution of gas. The acid frets the stomach, and much additional suffering results from its flatulent distention. Occasionally, and especially when a cancerous *ulcer* exists in the stomach, the food unduly detained there undergoes the butyric fermentation or common putrefactive changes, and thus gives rise to fetid eructations and the other symptoms of "surfeit," which, from their infrequency in other chronic diseases of the stomach, are often important evidence of the existence of cancer. In many cases, perhaps in all those in which the body of the stomach remains sound, the obstruction of the pyloric orifice leads, after a time, to great enlargement of the stomach. When this has taken place, vomiting occurs more rarely—at the end of each day, or every two or three days, or at still longer intervals—and a great quantity is brought up at once: the matter ejected comprising the accumulated secre-

tions of the stomach and all the food not capable of absorption in the stomach that had been eaten since the last vomiting.

When, on the other hand, the disease involves the *cardiac* orifice, the entrance of food into the stomach is impeded. The act of swallowing causes pain, or a sense of uneasiness, at the epigastrium, passing through to the back; and very commonly a small portion of what is swallowed lodges in the lower end of the œsophagus, and is immediately or speedily brought up again by an effort of eructation rather than of vomiting. The patient himself is aware that the food does not readily enter the stomach.

In all cases where much is rejected by vomiting, and but little consequently passes into the duodenum, the bowels become confined; but where the pylorus is not obstructed, the costiveness is interrupted now and then by a transient diarrhœa, produced by the irritating matters which pass from the stomach into the bowel.

When the cancer involves the body of the stomach or the pylorus, the matters brought up from the stomach, besides the natural secretions of the stomach and portions of the food more or less digested or otherwise altered by some fermentative process, often contain a considerable quantity of glairy mucus, secreted, for the most part, by the diseased portion of the mucous membrane. It sometimes happens, early even in the disease, that this mucus is mixed with black or brown flakes, consisting of blackened and altered blood. At a later period, and especially after ulceration has occurred, an abundant hemorrhage not unfrequently takes place. A sense of weight or oppression at the epigastrium is then felt, with faintness and nausea, and a large quantity of matter is vomited, which, according to the time the blood remained in the stomach and the quantity of free acid the stomach contained, is of a soot-black, or of a dirty reddish brown, justifying its familiar comparison with coffee-grounds. This matter owes its peculiar colour to black or brown flakes, formed of blood that oozed from the diseased surface, and as it issued from the vessels was clotted and blackened by the acid secretions of the stomach.

But, before the disease has advanced thus far, the patient has generally lost much of his flesh and strength, and has the pallid and faded look so constantly seen in the latter stages of malignant disease. By careful examination of the belly, we may now generally feel an irregular tumour formed by the cancerous mass. The situation of this tumour of course varies with the site of the disease as regards the stomach itself, and also, when the pyloric end is the

part diseased, with the degree of displacement which the stomach has undergone.

When the disease involves the cardiac orifice, which does not admit of displacement, or when it occupies the body of the stomach without obstructing the pylorus, the tumour is necessarily in the place which the diseased portion of the stomach naturally occupies.

Most commonly, as we have seen, the disease involves the pyloric end of the stomach. In that case also the tumour is usually felt about the place which the diseased portion naturally occupies; but when the stomach grows large, and the diseased portion has not contracted unnatural adhesions to the contiguous fixed parts, the pylorus falls in the belly, and the tumour may be felt much lower down in the right side, and even in the right iliac fossa. The tumour is felt more or less readily and distinctly, according to the part it occupies. A tumour at the cardiac orifice of the stomach which lies deep, directly behind the lower end of the sternum, so that the hand cannot be pushed against it, is much more difficult to define or to feel than one which is somewhat lower down in the belly. Deep-seated tumours can indeed, in all cases, be most readily and distinctly felt when they are near the middle of the belly, for the reason that the hand can there be pushed to a greater depth. If the linea alba be considered as a cord attached to two fixed points,—the lower end of the sternum and the pubes,—it will be plain that the middle of it is the place at which this can be pushed to the greatest depth from the straight line joining the two points.

Great enlargement of the stomach, which so constantly results from strictured pylorus, may be generally ascertained by an unusual resonance on percussion. Often, too, on looking at the belly, the outline, or part of the lower outline, of the distended stomach may be seen, and if such examination be made day after day, this outline will be found to vary according to the degree of distention of the stomach at the time. When the pylorus is completely strictured, the vermicular movements even of the stomach can sometimes be plainly seen through the walls of the belly. This happened in a very striking degree in a poor man who died in the hospital in the spring of 1855. In this instance the mere handling of the belly excited strong movements of the stomach—the stomach seemed to roll, and a wave of contraction passed along it, which was most distinctly seen about the cardiac end.

The tumour can be the more readily felt, and the outline of the stomach be the more distinctly traced, in consequence of the thin-

ness of the walls of the belly, which results from the general wasting, and in consequence also of the bowels being generally empty and contracted. When the aperture of the pylorus is much obstructed, and but little consequently passes from the stomach into the duodenum, the belly, except where it may be raised by the tumour or by the distended stomach, is almost always sunk or hollowed. The intestines contain but little fæcal matter, and, notwithstanding the costiveness, are seldom distended with gas.

The course of the disease is in some degree further modified by the development of secondary cancerous tumours in other organs.

When the primary cancer is either scirrhous or medullary, the lymphatic glands near the stomach, and to which the lymphatics of the stomach run, become tainted, and secondary cancerous tumours sometimes form in the liver, leading to enlargement of the liver, and now and then to an unevenness of its surface, which, from the empty state of the bowels and the general wasting, can in most cases be readily felt.

The dissemination of gelatiniform or colloid cancer usually leads, as we have seen, to scattered masses of gelatiniform cancer over the peritoneum and omentum, and its most striking results are distention of the belly and ascites.

While these organic changes are taking place, and revealing themselves more and more distinctly to our senses, there is a gradual diminution of flesh and strength, and the pain or uneasiness at the epigastrium continues, attended frequently with pain or uneasiness in the corresponding part of the back and in the loins, which is probably owing to the lymphatic glands behind the stomach, and to which the lymphatics of the stomach or the liver run, becoming tainted with the cancer. The temper likewise grows more irritable and morose, and the nights are restless. The loss of appetite is generally complete: but even now, unless the cancer be in rapid growth, there is seldom fever—the skin is cool, the pulse not much quicker than it should be, and the tongue clean or only slightly furred.

After a time, usually varying from six months to two years, but occasionally, especially in colloid cancer, extending to several years, the patient, worn out by want of nourishment, by pain and broken rest, and it may be by loss of blood, dies of exhaustion—the mental faculties and the senses remaining in most cases unimpaired, almost to the last.

Such is the usual course of cancer of the stomach. Cases, how-

ever, are now and then met with in which some of the most characteristic symptoms are wanting. Thus, in a person advanced in life, and where the cancer grows slowly, the pain, instead of being severe or harassing, as it usually is, may be so slight that it is little if at all complained of; or the tumour, from being small and at the back of the stomach, or from being overlapped by an enlarged liver, may not be felt; or again the disease may not obstruct the pylorus, and may involve only a small portion of the stomach, and vomiting may not be frequent enough to attract much notice.

The cases most difficult to distinguish as cancer are those in which the disease involves only a small portion of the hinder part of the stomach, and does not obstruct either of its openings. There are then, as in other cases, loss of appetite, more or less complete, progressive waste of flesh, and after a time the cachectic condition which cancerous disease so commonly causes, but in other respects the symptoms, even when ulceration has occurred, may differ but little from those of simple ulcer. The pain after food may indeed be less severe and the vomiting less frequent than in cases where there is a simple ulcer of equal size, because the raw surface is often less tender and irritable in a cancerous ulcer than in one occurring in healthy tissues.

Instances of this kind are however comparatively rare, and in the great majority of cases the disease follows more or less closely the course I have described.

The existence of cancer of the stomach is the more difficult to ascertain, from our not knowing its causes or any circumstances in which it is especially apt to occur. It does not, indeed, often occur before the age of thirty-five; but in persons beyond this age it is met with, and with no observed differences as to frequency, in all conditions of society. Rokitansky has remarked that tubercle and cancer are seldom developed together, and seldom arise in succession in the same person; and infers that the constitutional states which favour the occurrence of the one disease oppose the development of the other. It is not impossible that future observation may disclose some unsuspected relations between cancer and other forms of disease, and that it may point out even some more direct indications of the cancerous diathesis; but at present we have no light of this kind to guide us. In persons therefore beyond the age of thirty-five, there are no circumstances that give unusual significance to symptoms; and until the disease has lasted some time the symptoms, as we have seen, have seldom any characters that are peculiar

or especially significant. Pain or uneasiness referred to the stomach and increased by food, sour eructations, occasional vomiting, and lowness of spirits,—which are often the only symptoms noticed for some weeks, or even months,—may all arise from simple ulcer of the stomach, and from many other conditions.

After some time, the disease is easier to detect. The circumstance, that the symptoms have continued, or rather that they have got gradually worse—that the pain has become more harassing, or the vomiting more frequent, and the loss of appetite more complete—in spite, it may be, of a restricted diet, and of other means which usually relieve such symptoms when they are the effect of superficial inflammation of the mucous membrane or of mere functional disorder,—the circumstance, I repeat, of this continuance, or rather of this aggravation of the symptoms, leads to the inference that they result from organic disease; while the progressive loss of flesh, and the faded look, and often a morbid moroseness or despondency, must excite a strong suspicion that this disease is cancer. Such a suspicion will be confirmed, if much mucus, especially mucus mixed with brown or black flakes, should be thrown up from the stomach. When the mucous membrane is invaded by cancer in considerable extent, this frequently happens; but in simple ulcer of the stomach, the disease most likely at this time to be mistaken for cancer, it happens but rarely. In cases of simple ulcer, indeed, the disease is limited to the ulcerated spot—the mucous membrane in other parts of the stomach, even up to the edge of the ulcer, being usually healthy.

After the disease has existed for some months and the patient is much wasted, a tumour may, in most instances, be felt in the region of the stomach. When such is the case, and when the discovery of the tumour has been preceded by the symptoms I have mentioned, and the patient is of an age when cancer of the stomach is common, little doubt can remain that the disease is cancer. Vomiting of a large quantity of matter of a soot-black or dark-brown, like coffee-grounds, which, as I have already observed, often happens in advanced stages of cancer, would, of course, render this inference still more sure.

In a person who has led a temperate life, the same inference may be drawn when, without any palpable tumour, the symptoms show clearly that the pylorus is much obstructed. Stricture of the pylorus sometimes results, as we have seen, from the hardening and contraction of lymph, poured out in consequence of inflammation, in the cellular tissue under the mucous coat; but this disease, like

cirrhosis of the liver, which is likewise caused by the interstitial deposit of coagulable lymph, is almost always the effect of spirit-drinking. Stricture of the pylorus may be caused, too, by the cicatrization of a simple ulcer at the pyloric end of the stomach or in the upper part of the duodenum; but such an event is extremely rare, compared with stricture of the pylorus from cancer, and, when it does occur, the symptoms which preceded those of stricture, and sometimes the age of the patient, help us to distinguish the disease from cancer.

In distinguishing cancer of the stomach, it is also very important to consider the time the disease has already lasted, and the actual condition of the patient with reference to it. In cancer, the disease makes continual progress, the patient grows gradually thinner, and, in three cases out of four, dies of exhaustion within twelve months; in a very large proportion of cases, within two years. Simple ulcer of the stomach, the organic disease most likely to be confounded with cancer, may on the contrary exist for many years, causing almost constant, and even severe, suffering, but without destroying the appetite or causing much waste of flesh. If the disease, therefore, has existed for several years, or even for many months, without much loss of flesh, the chances are greatly against its being cancer.

In some cases it is possible, after a time, not only to tell that the disease is cancer, but also to specify the particular kind of cancer.

The different kinds of cancer differ in their rate of progress. Medullary cancer grows much more rapidly and becomes sooner and more widely disseminated than scirrhous and colloid cancer.

They differ, also, as regards the direction in which dissemination of the cancer takes place. Scirrhous and medullary cancer, when they become disseminated from the stomach, usually give rise to cancerous tumours in the liver, and thus cause enlargement of the liver and other symptoms of primary cancer of this organ. Colloid cancer, on the contrary, when it becomes disseminated, leads to secondary cancerous tumours in the mesentery, but very seldom to the formation of any similar tumours in the liver.

The different kinds of cancer differ, moreover, in the degree of pain and constitutional disturbance they occasion. Medullary cancer and scirrhus cause much more pain and constitutional disturbance than colloid cancer, which, when it involves the pylorus, ge-

nerally causes death by its mere mechanical effect in obstructing the passage of food.

If, therefore, after the disease has lasted some months, the liver grows large and there are other symptoms indicating the existence of cancerous tumours in it, the inference may be drawn that the cancer is medullary or scirrhous: if the disease make very rapid progress, that it is medullary rather than scirrhous.

If, on the contrary, the disease progresses slowly, and causes little pain that is not fairly attributable to distention of the stomach, and little constitutional disturbance, and if, at the end of twelve months, there is no enlargement of the liver, the inference will be, that colloid is the variety of cancer. This inference will be confirmed if ascites or any other symptoms should render it probable that there are secondary cancerous growths in the peritoneum or omentum.

In cancer of the stomach, the chief object of treatment is to lessen the sufferings of the patient.

One of the most effectual means of doing this is by properly regulating the diet. In this disease there are, as we have seen, many conditions—the destruction of a portion of the digesting membrane by the cancer, the decomposing or unhealthy secretions furnished by the cancerous surface, the impediment to the natural movements of the stomach which the disease causes, and very frequently, obstruction of the pyloric orifice—which tend to prevent the healthy action of the stomach, and give rise to various disorders of digestion that terribly aggravate the sufferings that are directly attributable to the cancer itself.

It is obvious, when such impediments to healthy digestion exist, that the digestive power should never be over-taxed, and that great care should be taken that the food required to nourish the body is reduced to its most easily-digestible form.

When the pylorus is obstructed, the solid food should be reduced to a state of pulp, so that, if not dissolved in the stomach, it may pass with the least possible difficulty into the duodenum.

In advanced stages of the disease, when a large portion of the stomach is involved in the cancer and its digestive power is greatly impaired, the food should be such as will pass readily through the pylorus and can undergo some kind of digestion afterwards. Arrowroot, and other light farinaceous food; beef-tea or nicely prepared soup; the yolks of eggs beaten up with sugar and with cold arrowroot that

has been boiled in water, and then mixed with water and wine; and a small quantity of the cooked pulp of some fruit,—are the substances of which the diet should mainly consist.

Much of the suffering in cancer of the stomach is at all times caused by food which the stomach cannot digest: and in the final stage of the disease in some instances—when a digesting fluid is no longer secreted, or the pyloric orifice is closed: when, consequently, food distends and oppresses the stomach without supporting the body—marked relief from pain and other discomfort will result from the patient almost entirely ceasing to eat—eating only an occasional spoonful of milk—and supporting the body as much as possible by nourishing enemas.

Much alleviation of suffering may also result from the judicious use of medicines.

When, for example, much mucus is secreted in the stomach, or when, as seems sometimes to happen, the irritation of the cancer causes an excessive secretion of gastric acid, benefit often results from the astringent action of bismuth, which is best given a short time before meals.

When there is an excess of acid, much relief is obtained from neutralizing this by lime-water and magnesia. While there is a great excess of acid in the stomach, there is usually a repugnance to food; but the disposition to take food and some power of digestion often return when the excess of acid has been neutralized by a dose of magnesia. The excess of acid commonly results from a process of fermentation in the stomach, which leads also to the generation of carbonic acid, or some other gas; and the acid and the gas together bring on vomiting. The fermentation may be impeded, and the evils resulting from undue acidity and flatulence be to a certain extent prevented by brandy, and by dill-water and other aromatics, which may be combined with bismuth, or with alkalies, when these are necessary.

When there are fetid eructations, indicating the development of sulphuretted hydrogen, pills, containing small doses (from one quarter to one half minim) of creosote may be given with advantage at each meal; or a few grains of the bisulphite of soda; or some finely-powdered wood-charcoal.

It is requisite, also, to obviate constipation, which is a very common effect of cancer of the stomach, and which almost always renders the patient more irritable and uneasy than he otherwise would be. The best way to obviate constipation is to give occasionally an

aloetic, or a compound colocynth pill. The pill does not oppress the stomach by its bulk; and aloes and colocynth, which exert their chief action on the large intestine, are less apt to offend the stomach than most other purgatives.

Again, cancer of the stomach, especially when far advanced, causes loss of sleep, harassing pain in the stomach and back, and much nervous irritability; and, to mitigate these evils, recourse must be had to sedatives and narcotics. These may be given singly, or in various combination, according to the particular object in view, or the effects which they are found to have on trial. To procure sleep, no other sedative is so efficient as opium. To alleviate pain, and to allay general nervous irritability, the medicines most in repute, and probably the best, are conium and belladonna, which have the additional advantage of not confining the bowels, and checking the secretions, as opium does.

Proper regulation of the diet, the well-timed use of alkalies and sedatives, prevention of constipation by pills of colocynth or aloes, and avoidance, as much as is possible, of conditions which exhaust the strength, are the principal means we have to alleviate suffering and prolong life. In many cases the relief, even from the most judicious employment of these means, is comparatively small. The cancer gradually spreads, everywhere changing the coats of the stomach as it creeps on, and blending them with its own mass; and, at length, by blocking up the pylorus, or by greatly impairing digestion, and, also, in many cases, by causing hemorrhage, exhausts the strength of its victim.

It is clear that such results (and it is not in our power to prevent them) cannot be produced without much suffering of various kinds.

LECTURE IX.

Sympathetic Disorders of the Stomach from irritation elsewhere.

HAVING passed in review the organic diseases of the stomach, we have next to consider its functional disorders, which are far more frequently presented to our notice.

Functional disorders of the stomach, of some kind or other, must, indeed, result from organic disease. To do its work well, the stomach must be sound and be properly nourished.

When, from the blood being impeded in its course through the liver or the chest, the stomach is kept congested, the nutrition of its mucous membrane is impaired, gastric juice is secreted in small quantity, and digestion is consequently slow and feeble. In high degrees of congestion, the secretion of gastric juice is almost suspended, and blood oozes from the open surface of the mucous membrane.

When the mucous membrane of the stomach is inflamed, the secretion of gastric juice is arrested or very much lessened, and an unhealthy mucus, prone to pass into decomposition, is cast off from the membrane. The results of the disease are—loss of appetite, thirst, pain and a sense of heat in the stomach after food has been taken, and, it may be, vomiting. If, under the influence of decomposing mucus in the stomach, some unnatural fermentation is set up in the food, much other disorder is superadded to this.

When a simple ulcer of the stomach exists, gastric juice may be secreted to digest the food and nourish the body; but the presence of food in the stomach, unless it be in small quantity and of the least irritating kind, frets the sore and causes pain; the natural movements of the stomach are often hindered, so that it cannot be completely emptied; from the surface of the sore there is a discharge, which is offensive to the rest of the stomach; the sore itself, being a constant source of irritation, is apt to excite disordered action of the muscular coat, and to cause an outpouring of gastric acid when there is no food in the stomach to dissolve; and from these causes, separate or combined, there is occasional vomiting.

When the stomach is the seat of cancer, there is usually, again, pain or a sense of oppression after food, and various disorders resulting from the morbid secretions of the diseased mucous membrane and from the narrowing of the orifices or the impediment to the proper movements of the stomach which the disease occasions.

All this has been fully considered in the preceding lectures.

Functional disorder of the stomach may result not from organic disease of the stomach merely, but from organic disease of other organs; and that, not by the constitutional disturbance which this disease sets up or by any change it may cause in the state of the blood, but by an influence transmitted through the nerves.

An illustration and a type of disorder of the stomach so produced, is seen in an experiment long ago performed by Spallanzani.

Spallanzani excited vomiting in himself by tickling the fauces, in the morning before breakfast, when the stomach was empty of

food, and when, as we may infer from the recent observations of Dr. Beaumont, it contained no gastric juice. By the act of vomiting, more than an ounce of fluid was thrown up, and by then exciting vomiting again in the same way, he obtained a still larger quantity. He then tested the digestive properties of this fluid, and found that it dissolved meat and prevented its putrefaction. The fluid consisted, therefore, at least in part, of gastric juice.

Here, then, mechanical irritation of the fauces not only excited reflex action of the muscles to produce vomiting, but also excited, in the same way,—by reflected nervous influence,—a secretion of gastric juice.

Irritation of the lung, or of the brain, or of the liver, or of the uterus, from certain kinds of organic disease, frequently leads, as it is well known, to *sympathetic* vomiting—that is, to vomiting caused by nervous influence reflected from the seat of disease upon the muscles which perform this act. The matter vomited in such cases is frequently acid, even when digestion is not going on; and, as we have already seen, the stomach exhibits the action of the gastric juice after death, more frequently in persons who die of diseases that cause this sympathetic gastric disorder, than in others. Whence we may safely infer, that the reflex nervous influence excites, not merely the act of vomiting, but also, in many cases, as in the experiment of Spallanzani, a secretion of gastric acid.

A familiar instance of this gastric disorder is seen in phthisis. In most cases of phthisis, indeed, vomiting occurs sooner or later, and the functions of the stomach are otherwise disordered; and not unfrequently, in certain stages of the disease, there is more suffering from the stomach disorder, than from symptoms immediately referrible to the lung.

In phthisis, vomiting may be brought on in several ways.

Sometimes, especially at an early stage of the disease, when the cough is dry and hard, vomiting results from the mere violence of the cough; occurring as in hooping cough, only at the end of hard fits of coughing, and without much loss of appetite or of digestive power, and with little or no pain in the stomach.

When brought on in this way, it is most effectually controlled by sedatives, which lessen the frequency and the violence of the cough, on which the vomiting depends. Three minims of dilute hydrocyanic acid, with from a twelfth to a twentieth of a grain of muriate of morphia, three times a day, generally succeeds in mitigating, if not entirely removing, this variety of gastric disorder.

More commonly, vomiting occurs later in the disease, usually attended by loss of appetite and by pain and a sense of heat at the stomach, and the matter vomited is usually sour. These symptoms, unless proper means be taken to prevent them, continue many weeks or months—in fact, often till death—and after death, in such cases, the mucous membrane of the stomach in the big end is very commonly found thin and soft. Now and then all the coats are completely dissolved.

These facts have been accurately noted by M. Louis, in his elaborate work on Phthisis, in which the changes of structure found in the stomach after death are supposed to have occurred during life, and to account for the gastric disorder.

One circumstance incompatible with this supposition is noticed by M. Louis—it is, that the changes of structure found after death do not correspond in degree with the severity or duration of the gastric symptoms. The change of structure is sometimes great where the gastric disorder has been slight; and where the symptoms have been severe and prolonged, the stomach is sometimes found perfectly uninjured.

I have endeavoured to show in a former lecture that the gastric symptoms in such cases originate, not in structural disease of the stomach, but in undue and untimely secretion of gastric juice and other functional disorder excited by reflex nervous influence. The functional disorder may, after a time, lead to an inflammatory or a catarrhal state of the mucous membrane, which will be an additional cause of disordered digestion; but the *softening* of the stomach that so commonly occurs takes place after death, from the action of the gastric acids, and cannot be expected, therefore, to have a constant relation to the symptoms in degree, since the extent of softening depends merely on the quantity of gastric acid which the stomach happens to contain at the time of death, on the temperature at which the dead body is kept, and on the time after death at which it is examined.

The best remedies for this gastric disorder are alkalies, to neutralize the excess of acid in the stomach, and astringents, which tend to restrain undue secretion by the mucous membrane.

Fifteen grains of bicarbonate of potash, or fifteen minims of liquor potassæ, or an ounce and a half of chalk mixture, three times a-day; or, better still, the vegetable astringents,—logwood, krameria, catechu, kino—will generally stop the vomiting for a time, and alleviate the other symptoms of this gastric disorder.

Astringents should be given a short time before meals: alkalies, two or three hours after meals.

In the advanced stages of phthisis there is often, especially in women, another cause of gastric disorder. The liver grows fatty and large, and overlaps and compresses the pyloric end of the stomach, leading to that enlargement of the stomach so commonly found in persons dead of phthisis, and, in a slight degree, to the various evils of obstructed pylorus. For these evils, as we cannot remove the cause on which they depend, we have no effectual remedy.

Disorder of the stomach of the same kind sometimes originates in the liver, especially from the irritation caused by an abscess or from the passage of gall-stones.

I shall only speak here of the effects of the passage of gall-stones, which, in this country, is by far the more common condition.

The illness in such cases generally comes on suddenly, two or three hours after eating, with severe pain, like that of colic, in the region of the gall-bladder. The pain abates, and recurs again in paroxysms, attended by a sense of constriction at the lower part of the chest, and commonly by distressing nausea and frequent vomiting. The matters vomited are often very sour, even when the stomach has been previously completely emptied of food.

Now and then, after the stomach has been completely emptied of food, and when nothing more is eaten, enormous quantities of acid are brought up by the repeated efforts of vomiting. This acid, which is obviously secreted by the coats of the stomach, was found by Prout to be the *muriatic*.

After the symptoms have continued some time they generally cease *suddenly*, as the stone passes out of the gall-duct into the bowel.

The sequence of events, in such cases, is as clear as if it resulted from direct experiment. The gall-stone passes into the common duct, and immediately causes severe pain, with vomiting and the outpouring of an acid fluid from the stomach. The stone escapes from the duct into the duodenum, and the pain, the vomiting, and the undue secretion of acid in the stomach, cease at once.

There is no mistaking the relation of the facts. The mechanical irritation of the stone in its passage through the gall-duct causes vomiting by nervous influence reflected on the muscles that perform that act, and causes untimely secretion of acid in the stomach, by nervous influence reflected on the secreting structure in its mucous coat.

The muriatic acid must be derived from the decomposition of common salt in the secreting apparatus of the stomach; so that mere mechanical irritation of the lining membrane of the gall-duct, by means of an influence transmitted by the nerve, sets in action, in a distant part, a muscular power and a chemical power,—a muscular power that empties the stomach by almost convulsive efforts of vomiting, and a chemical power that causes, in the coats of the stomach, the rapid decomposition of common salt.

The facts, as mere objects of scientific interest, are very remarkable, and important inferences regarding the actions of the body in health as well as in disease, are deducible from them. It has, for example, long been a disputed question—What is the proper acid of the gastric juice? And the question has proved difficult of solution, because the stomach generally contains no acid when it is empty of food; and, if vomiting be excited and the contents of the stomach be analyzed, while digestion is going on, any acids that may be formed from the food in the process of digestion are mixed with the acid secreted by the coats of the stomach itself. During the passage of a gall-stone, on the contrary, acid is sometimes abundantly secreted by the coats of the stomach, and is thrown up, unmixed with acid from other sources; so that, if the acid vomited in such cases be the muriatic, we are led to the conclusion which was formed by Dr. Prout, and which recent researches have confirmed, that muriatic acid is the proper acid of the gastric juice. The irritation caused by the passage of a gall-stone is probably reflected on the muscles that cause vomiting, and on the secreting apparatus of the stomach, in different relative degrees in different cases. In some cases the muscles may be chiefly excited, and there may be severe and frequent vomiting, without much increased secretion; in others, there may be greatly increased secretion, while the vomiting is slight.

The same difference is observed in different cases, in the gastric disorder in phthisis.

The passage of a gall-stone, which produces this secondary disorder in the stomach, causes severe pain in the injured gall-duct; and, as a general rule the gastric disorder is doubtless greater the more severe the pain. We must bear in mind, however, that the irritation of internal parts may cause severe sympathetic disorder, without causing any pain. A worm in the bowel, which causes no pain there, may be the exciting cause of spasmodic disorder. An old abscess in the liver, not painful in itself, may occasion frequent

vomiting. An injury in the hand or foot attended with little pain, may give rise to the fatal spasms of tetanus.

It is not, therefore, a valid objection to the explanation given above of the gastric disorder in phthisis, that in some of the cases in which this disorder is great there is little or no pain in the chest. The irritation is transmitted to the central organs of the nervous system, and there reflected so as to cause the sympathetic disorder of motion or of secretion, though it be not of such kind as to cause pain.

During the passage of gall-stones, considerable and speedy relief to the gastric disorder may often be given by alkaline medicines. Dr. Prout especially recommended frequent draughts of hot water, containing carbonate of soda in solution—from one to two drachms of the soda to a pint of water. "The alkali," he says, "counteracts the distressing symptoms produced by the acidity of the stomach, while the hot water acts as a fomentation to the seat of pain. The first portions of water are commonly rejected almost immediately; but others may be repeatedly taken; and, after some time, it will be usually found that the pain will become less, and the water be retained."

Bismuth and chalk combined, which, when there is free acid in the stomach, acts both as an alkali and an astringent, is often of still greater efficacy in the vomiting sympathetic of hepatic disease. From five to ten grains of prepared chalk, and as much of the trisnitrate of bismuth, may be suspended in water by the mucilage of tragacanth, and given, together with minute doses of morphia, as often as the symptoms require.

The passage of a renal calculus along the ureter affects the stomach in the same way, and often just as much, as the passage of a gall-stone along the common duct.

The same kind of gastric disorder may result from disease of the brain, especially from inflammation of the brain or its membranes. It has been long known, that vomiting is a frequent and often a prominent symptom of such disease; and the circumstance to which I have before referred, that in persons who have died of it the mucous membrane of the stomach in its big end is frequently found more or less dissolved or digested by the gastric juice, shows that the irritation of the brain does not excite merely the mechanical act of vomiting, but that it excites also, at least in many cases, untimely secretion of gastric acid.

It is in inflammatory diseases of the brain, more than in other

diseases, that this gastric disorder is seen; and it occurs especially *in the early stage of those diseases*, when the symptoms betoken irritation of the brain, rather than compression. Andral, who has investigated this subject with much care, says:—

"Vomiting, or at least nausea, very frequently attends acute inflammation of the membranes of the brain. These symptoms show themselves almost exclusively in an early stage of the disease, and they often mark its onset. In some cases, they are not often repeated, and excite little attention, and cease to recur at the end of twenty-four hours. In other cases, on the contrary, they continue many days, and sometimes even during the entire course of the disease."

This circumstance explains how it happens, that when death results from inflammatory disease of the brain, the stomach is, in some cases, found perfectly sound; while in other cases, which are comparatively few in number, it exhibits in high degree the changes which are produced after death by the solvent action of the gastric juice.

These changes cannot take place unless there be a good deal of free acid in the stomach at the time of death; which is seldom the case, unless the gastric disorder have continued to the time of death, and which may not be the case even then.

The gastric disorder varies very much in different cases, not merely in duration, but in severity while it continues; and probably in the relative degree in which the muscles and the secreting function are affected. Andral says, "Some patients vomit only two or three times a-day; others at much shorter intervals—every hour, for instance, or every quarter of an hour. Many patients throw up in this way, in a short time, an enormous quantity of yellow, or greenish bile; others in the midst of painful efforts, only expel a little mucus. There are some who cannot take a spoonful of drink without bringing on vomiting."

This gastric disorder, like other sympathetic nervous disorders, occurs more frequently, and in higher degree, in women than in men, and in children than in grown-up persons.

The vomiting or nausea is sometimes attended by pain at the epigastrium and in some degree of tenderness, especially, I believe, where the secreting function is especially disordered; but these symptoms are less frequently noticed than in phthisis—in consequence, probably, of the shorter duration of the gastric disorder in most cases, and of the severe pain of the head which usually attends

inflammatory diseases of the brain, and which prevents the patient from feeling, or regarding, a slighter pain in the stomach.

Where the gastric disorder is attended with secretion of much acid, soda and magnesia, chalk and bismuth, are the remedies which most allay it.

Gastric disorder of the kind we are considering results more frequently still from organic disease of the uterus.

The effect of irritation of the uterus in causing vomiting was shown with the distinctness of direct experiment in the following case related by Dr. Gooch.

"Dr. Denman passed a ligature round a polypus of the fundus of the uterus: as soon as he tightened it, he produced pain and vomiting. As soon as the ligature was slackened these symptoms ceased, but whenever he attempted to tighten it the pain and vomiting returned. The ligature was left on, but loose. The patient died about six weeks afterwards, and, on opening the body, it was found that the uterus was inverted and that the ligature had included the inverted portion."

Frequent and distressing vomiting now and then occurs, as is well known, in women afflicted with cancer of the uterus: an effect, no doubt, of reflex nervous influence: and the circumstances that, in such cases, the vomiting is often attended by pain at the stomach and thirst, and that the coats of the stomach are occasionally found much softened or digested after death, show, as in the instances I have before cited, that in many cases, at least, this reflected nervous influence disorders the secreting function of the stomach, as well as the muscles.

Disorder of the stomach of the same kind now and then occurs when miscarriage is about to take place, and also in conjunction with chronic ulcer of the neck of the womb. In the latter class of cases, the sufferings referrible to the stomach may be so severe and long-continued, and the pain in the womb so slight, that both the patient and her medical attendants may have their attention more fixed on the secondary functional disorder than on the primary disease.

In these diseases of the uterus, indeed, as in tuberculous disease of the lung, the degree of disorder of the stomach has no constant relation to the degree of *pain* in the primary seat of disease.

The same kind of gastric disorder now and then results from what might seem to be very trifling causes of disturbance. In nervous women, particularly in those whose sensibility has been exalted

by losses of blood or by a state of anæmia brought on in any other way and in whom digestion is habitually feeble, the direct irritation of the coats of the stomach by an unwholesome or undigested morsel of food may excite the disorder, which, if any other disturbing influence exist, may subsequently be kept up for weeks, or even months together, unless great care be taken not to irritate the coats of the stomach by physic or food.

When the disorder originates in this way, it usually comes on in the evening, or at night, and especially after fatigue. The illness commences with vomiting or nausea, which is followed by pain or uneasiness at the pit of the stomach, and, if the disorder continue long, by loss or great impairment of appetite, and by thirst. The stomach sometimes becomes extremely irritable, so that vomiting recurs frequently, and is at once brought on by swallowing any food, or even the simplest drinks. There is then severe pain at the pit of the stomach, and the matters vomited are usually bitter. When the stomach is less irritable, food is retained for a time, and the matters rejected from the stomach are intensely sour. The acid thrown up in such cases is probably not all secreted by the coats of the stomach. The continued disturbance of the secreting function of the stomach seems to lead to an inflammatory, or a catarrhal state of the mucous membrane. The digestive power is greatly weakened, and under the influence of unhealthy or decomposing mucus the starchy principles of the food undergo fermentation in the stomach, by which large quantities of lactic acid are formed. The undue acidity of the stomach, or the great disturbance of its secreting function, lessens the secretion of the liver, and after the disorder has continued some days the countenance sometimes becomes slightly sallow. The symptoms are then not unlike those produced by the passage of gall-stones, and are almost as severe. The sallowness, however, when it occurs, never attains a high degree, and is generally transient, while the gastric symptoms are often of much longer continuance than those usually are which result from the passage of gall-stones. In some cases they continue with slight intermissions for months together, and lead to the suspicion of serious organic disease.

This happened in the case of a lady fifty-seven years of age, who came under my care in the summer of 1845. She had then been subject for many years to attacks such as I have described, of most distressing vomiting, attended by severe pain at the epigastrium. The matters vomited were always sour, and, when the vomiting

was frequently repeated, were bitter. In some attacks, after these symptoms had continued a day or two, the countenance became sallow.

It was supposed that the attacks might be owing to the passage of gall-stones; but, though diligent search was often made for them in the matters discharged from the bowels, none were ever found there.

The attacks generally came on in the evening, and were brought on, as she supposed, by fatigue, or by something unwholesome she had eaten. They occurred especially when she had been weakened by hemorrhage from internal piles, to which she was subject.

The piles were cauterized by nitric acid, and the hemorrhage ceased to recur. Upon this her general health improved, and the attacks became less frequent and severe.

I had heard nothing of her for three years, when, in the month of June, she called on me, looking stouter and healthier than four years before.

She told me that nine months before that time the stomach disorder came on again, and was so severe that she was confined to bed four months, vomiting almost everything she took. After trying various medicines in vain, she was speedily and perfectly cured by taking ten grains of bismuth and ten of magnesia every four hours, and a dose of soda, rhubarb, and calumba, at the hour of dinner.

The symptoms had recurred in a slight degree since, but were immediately stopped by the bismuth and magnesia mixture, which she believed to be a perfect remedy for these attacks.

I could cite to you many other instances where stomach disorder of this kind, seemingly induced in the way I have described, was so severe and long continued as to lead to the belief of serious organic disease. The disorder is, as I have stated, most common in women, especially in those whose nervous susceptibility has been exalted by losses of blood or otherwise; but it also occurs in men who have excitable nervous systems and whose digestion is habitually feeble.

The means I have found most effectual in mitigating and subduing the disorder are—bismuth, which may be given in doses of ten grains a short time before meals; an occasional dose of magnesia or chalk, to neutralize any excess of acid which the stomach may contain; regulation of the bowels by pills of colocynth or aloes; total abstinence from alcoholic drinks, which generally aggravate the dis-

order; and a diet composed of liquid and pultaceous food of the least irritating kind.

When the stomach has become tranquil, it is requisite, with the view of preventing a recurrence of the disorder, to stop any exhausting drain that may exist, and, by a course of steel medicines, by a nourishing but easily digestible diet, and by other means available for this purpose, to remedy the state of anæmia or the irritability of the nervous system from which the disorder springs.

The gastric disorder we are considering occurs, as I have before remarked, more frequently in women than in men. It occurs still more frequently, from a given cause of disturbance, in young children, in whom the secreting function of the stomach is very active, and who are especially liable to reflex functional disorders of other kinds.

Young children with tuberculous disease of the lung or inflammation of the brain, have this secondary gastric disorder more frequently than grown-up persons suffering from the same diseases, and their stomachs are more frequently acted on, and in higher degree, by the gastric juice after death.

They are not liable, like grown-up persons, to disorder originating in the liver or the uterus; but they have, at a certain period, a constant source of disorder in the irritation of teething, which frequently causes gastric disturbance, as it does some of the convulsive disorders to which young children are so subject.

The stomach disorder, like disorder of the muscles, occurs most frequently during the first dentition, in children weakened by the eruptive fevers, or by purgative medicines, improper food, or impure air. It is especially apt to occur on weaning, when the health of the child often suffers, not only from sudden change of food, but from the improper food often substituted for the mother's milk. Occurring under these circumstances, it has been properly known as the "weaning brash," and has been described in medical works as the "atrophia ablactatorum."

The early symptoms are frequent vomiting, with thirst, and fretfulness, and occasional writhing of the body and plaintive cries, expressive of pain. The matters vomited are sour and bilious, and are thrown up with more effort than attends the common "puking" of healthy children. These symptoms are sometimes attended with looseness of the bowels, the matters discharged from them being greenish, from the presence of bile rendered green by the free acid secreted by the stomach or formed by fermentation from the food,

and which has not been neutralized in its rapid passage through the bowels.

If the disorder continues, the child wastes rapidly and grows feeble, and soon exhibits the well-known signs of exhaustion,—coldness of the surface, irregular pulse, sighing and slight stupor,—signs which have been described by Dr. Marshall Hall as marking what he has termed the "hydrocephaloid disease" of infants.

In this state the child may die, and on examination of the body after death there may be no discoverable change of structure in any organ, or there may be found, in greater or less degree, that peculiar softening of the coats of the stomach, and sometimes (in cases in which there has been diarrhœa,) of portions of the bowels, also, that is produced after death by the solvent action of the gastric juice.

The disorder is to be controlled in infants much in the same manner as in grown-up persons. The gums should, if needful, be lanced, to lessen the irritation from which the disorder springs. The child should be fed with good milk, or milk and baked flour, or better still, if it be not more than twelve months old, with the milk of a healthy nurse, at short intervals and in small quantities at a time, and should have given to it, in doses suited to its age, chalk or magnesia or bismuth, or, if it can be got to take them, one of the less nauseous of the vegetable astringents, as krameria or logwood. If the disorder have already produced much exhaustion, a few drops of aromatic spirits of ammonia may be given occasionally with the milk, or with one of the medicines I have just mentioned.

We are now in a condition to take a general view of this peculiar gastric disorder.

It occurs, as we have seen, in grown-up persons and in children, in the male and in the female sex, but is most frequent, for the same cause of disturbance, in susceptible women and in children, especially in children ill-fed or reduced by previous disorders,—persons whose nervous systems are highly excitable, and who are very prone to sympathetic nervous disorders of other kinds.

It seldom exists unless there be some cause of disturbance elsewhere in the body, and occurs with especial frequency in conjunction with tuberculous disease of the lung, inflammation of the membranes of the brain, cancer and some other forms of disease of the uterus, the passage of gall-stones through the ducts, and, in children, while the gums are irritated and inflamed by teething. It occurs also in

cases of simple ulcer of the stomach, and in cancer of the stomach: irritation at the diseased part of the stomach causing, in these cases, undue and untimely secretion in the sound part.

When the exciting cause is of long continuance, or when a proper plan of treatment has not been followed, the gastric disorder in grown-up persons may continue in high degree, with occasional slight intermissions, for months together. In young children this cannot happen: the stomach disorder impedes nutrition, and brings on a state of exhaustion soon fatal of itself.

When the disorder has lasted some time, it is not always entirely functional. The continued functional disorder exhausts and weakens the stomach and sometimes induces an inflammatory or catarrhal state of the mucous membrane. The digestive power is further weakened, and the stomach secretes an unhealthy mucus, which promotes undue fermentation in the starchy principles of the food, and thus leads to the formation of large quantities of lactic acid, or some other acid of the same group, which are an additional cause of disturbance in the stomach and bowels.

Whether death has been occasioned by the gastric disorder or by the concomitant disease, the degree of change found in the stomach after death does not usually correspond with the severity or the duration of the gastric symptoms. The softening of the stomach, which is usually the most striking change observed in such cases, takes place, as we have seen, after death; and does not depend, therefore, on the severity or duration of the disorder, but mainly on the quantity of free gastric (muriatic or lactic) acid which the stomach happened to contain at the time of death. The disorder may have been severe and have lasted long, but the stomach may contain no free muriatic or lactic acid at the time of death, and may be found perfectly uninjured; while, on the other hand, the gastric disorder may have been very slight; so slight, even, as to have escaped notice; and yet muriatic or lactic acid may have been poured out, or lactic acid may have formed in the stomach in considerable quantity, just before death, and the stomach be found much dissolved.

This disorder has been very commonly attributed to inflammation; and the vomiting, the pain and tenderness at the epigastrium, the thirst, and, in fatal cases, the softening of the mucous membrane of the stomach often seen when the body was opened, have seemed to many conclusive evidence in favour of this opinion. Inflammation causes, indeed, vomiting, pain and tenderness at the epigastrium,

and thirst; but these symptoms may result from other conditions,—vomiting from irritation elsewhere; pain and soreness at the epigastrium, from the presence of free acid in the empty stomach; thirst, from this, and from the increased secretion which the disorder causes; and the peculiar softening of the stomach that has been observed in such cases, is not caused by inflammation, and can be explained only from the action of a free digesting acid in the stomach after death. The disorder may, as I have already observed, lead, after a time, to an inflammatory or catarrhal condition of the mucous membrane of the stomach; but, at its origin, and often long after, the disorder of the stomach is entirely functional, and is more allied to the excited and disordered state of the intellect in delirium tremens, or to the involuntary and disordered, and often violent, movements of the voluntary muscles in chorea, than to inflammation.

The power inherent in the voluntary muscle accumulates by rest, to be discharged at the will of the animal for its own purposes. The chemical power of digestion inherent in the stomach accumulates in the same way, to be discharged to serve an important purpose when food is placed in the stomach. Every kind of power which an animal can generate,—the mechanical power of the muscles, the chemical (digestive) power of the stomach, the intellectual power of the brain, the electrical power of the torpedo,—accumulates through the nutrition of the organ on which it depends. The accumulated power is discharged by an influence transmitted through the nerves; and, in a state of health, it is discharged in a degree regulated by the will or by the physical wants of the animal.

Power is expended only to the extent which the emergency requires. When, for example, food is placed in the stomach, whatever may be the capabilities of the stomach at the time, only so much gastric juice is secreted as is required for proper and speedy digestion. But in states of disease, the power is sometimes expended in undue measure and by nervous influence transmitted from unusual sources, without control of the will and without reference to the physical wants.

The disorder we have been considering is, at its onset, an instance of this kind.

The most effectual remedies for the disorder are,—

1. Sedatives, and other means which lessen the irritation from which the gastric disorder springs.

2. Alkalies and astringents.

Alkalies sometimes give immediate relief by neutralizing the acid which the stomach contains: astringents alleviate the disorder rather more slowly, but for longer time, by restraining the undue and untimely secretion.

The insoluble antacids—magnesia and chalk—are well suited to this disorder. They serve to neutralize any excess of acid that may be in the stomach, and, given under these circumstances, have an astringent action on the surface besides.

Bismuth, of which I have more than once spoken, has a remarkable effect in restraining undue secretion in the mucous membrane, and may often be given with advantage—alone, or in conjunction with magnesia or chalk.

While the disorder continues, the diet should consist chiefly of milk and farinaceous food, and little should be eaten at a time. Alcoholic drinks, and all stimulating articles of food, seldom fail to aggravate the disorder, and should be strictly forbidden.

If symptoms indicating an inflammatory state of the stomach should occur,—namely, a sense of heat in the stomach, and pain excited by food, tenderness at the epigastrium, and a white coat on the tongue,—a blister or mustard-poultices may be applied to the epigastrium; and the stomach may be cooled, and be rendered less irritable, by swallowing occasionally, and especially after meals, a small lump of ice.

If constipation exist, it may be remedied by medicines, such as pills of colocynth or aloes, which do not much offend or oppress the stomach.

In some cases of this sympathetic disorder all these means are unavailing: nothing will stop the vomiting while the original irritation exists.

LECTURE X.

Deficient secretion of gastric juice—Slow and imperfect digestion.

THE subject of the last lecture was the disorderly secretion of gastric acid, which may result from disease in some other organ unduly exciting, by means of reflex nervous influence, the secreting function of the stomach.

In a state of health the stomach contains no gastric juice while it is empty of food; but the contact of food with the mucous mem-

brane immediately causes the juice to flow from it in quantity sufficient for complete and easy digestion. The formation of gastric juice depends on the proper nutrition of the mucous membrane—just as the power of a muscle depends on the proper nutrition of the muscular fibre—but the outpouring of the juice when food touches the mucous membrane, like the outpouring of saliva from the presence of food in the mouth, is excited by reflex nervous influence; that is, the impression of the food on the surface is transmitted by the nerves to some central part of the nervous system, and thence reflected to excite the action of the secreting apparatus.

This reflex nervous influence, which causes the outpouring of gastric acid on the contact of food with the mucous membrane of the stomach, may be excessive; or it may be excited by other impressions on the mucous membrane of the stomach than those arising from the presence of food; or, lastly, it may be excited by irritation in other organs—producing in these several ways the disorders we considered at our last meeting: and, on the contrary, when there is food in the stomach and gastric juice is required, the nervous influence exciting the secretion may be deficient in energy, and the juice may be poured out in too small quantity for complete and easy digestion.

Dr. Wilson Philip showed, by various experiments on rabbits and other animals, that if the eighth pair of nerves be divided in the neck, any food which the creatures may afterwards eat usually remains in the stomach undigested; and, after death, the coats of the stomach are not found dissolved by the gastric juice, however long the animal may have lain dead.

The experiments did not warrant the conclusion that Dr. W. Philip drew from them,—that the secretion of gastric juice is entirely dependent on an influence transmitted through these nerves; but they proved that the division of the nerves and the injury and shock of the operation arrested the secretion for a time.

It is well known that long-continued watchfulness, or excessive fatigue, or great mental excitement, will prevent or take away the feeling of hunger and destroy for a time the power of digestion.

A man in the wild excitement of delirium tremens has a repugnance for food of every kind. When the delirium subsides and the nervous system has been refreshed by a few hours' sleep, the appetite and the power of digestion return.

In the case of St. Martin, to which I have before referred, Dr. Beaumont had ocular proof that the depressing passions of fear and

anger lessen the secretion of the gastric juice. Feebleness of digestive power, arising from this cause, is often seen in men of excitable temperament who suffer anxiety, or who overstrain their minds in the pursuit of wealth or other objects of ambition.

A scanty secretion of gastric juice may result from many other conditions. If the stomach be kept in a state of congestion, or if its mucous membrane be inflamed, the secretion of gastric juice is, as we have seen, arrested or diminished. The same thing happens, as is well known, in inflammation of other organs attended with fever, and in states of active fever, however induced.

A deficient secretion of gastric juice results also, independently of these conditions, from indolent and sedentary habits and the habitual consumption of more food than the system with such habits requires. The purpose of digestion is to supply the waste of the body; and it has been wisely ordered that the power of digestion shall increase with the waste. The day-labourer, who toils from sunrise to sunset in the fields, has generally some compensation for the hardships of his lot in the comfort of a strong and easy digestion. A man convalescent from fever or any other lingering and wasting disease requires, and can easily digest, much more food than when in established health; a woman suckling her child, much more than when she has no such drain. Where the increased need of food is of long continuance, the power of digestion is permanently increased, and the mucous membrane of the stomach becomes hypertrophied. This happens, as Dr. Todd has shown, in cases of diabetes. In this disease, a large part of the food, when dissolved in the stomach, does not undergo those other and ulterior changes which fit it to form part of the living blood, but, instead of this, becomes converted into a low form of sugar, which passes off in the urine without contributing to nourish the body. There is consequently an unnatural craving for food; food in large quantity is rapidly dissolved in the stomach; and, as is seen on dissection, the mucous membrane of the stomach acquires unusual development.

It often happens in the middle and upper classes of society that the secretion of gastric juice is only relatively deficient. The stomach can digest food enough to nourish the body, but not enough to satisfy the pampered appetite.

It has been clearly shown by the experiments of Spallanzani and Dr. Beaumont, that the quantity of juice required for digestion is proportioned to the quantity of food. When gastric juice has dissolved a certain quantity of food, it is saturated, and can dissolve

no more. The digestive power may, indeed, be restored, in a certain degree, by the addition of water, or by the addition of muriatic or lactic acid; but to carry digestion much further there must be a fresh quantity of the juice. If, then, a man eats too frequently or too much, the gastric juice may be inadequate for the proper and easy digestion of the food, without any fault fairly attributable to the stomach. The organ is simply overtaxed. Indigestion brought on in this way is the natural penalty for the violation of a natural law, or as a humorous writer has termed it, "the remorse of a guilty stomach."

Again, the secretion of gastric juice is not unfrequently scanty, in consequence of a permanent defect in the secreting apparatus of the stomach, when there is no disease elsewhere impairing its action, and when there is no great fault to be found with the habits of life. The stomach is sometimes weak from its original constitution; and when it is naturally powerful, it has sometimes its gland-structure injured, and is permanently weakened, by hard-drinking, or by the long-continued use of irritating drugs, or by diseases that much affect its secreting apparatus. I have met with many instances in which feebleness of digestion that seemed to be irremediable and permanent resulted from an attack of cholera, which probably does permanent injury in some cases to the glandular structure of the stomach.[1]

From any of these causes it may happen that gastric juice is secreted in insufficient quantity for the purpose of digestion.

We may next consider the form of indigestion thus resulting.

A necessary effect of an insufficient secretion of gastric juice is, of course, *slowness* of digestion. The food, instead of being completely digested and passing out of the stomach in two or three hours, remains undigested, or only partially digested, for a much longer time,—it may be, for twelve, or even twenty-four hours. The undigested portions of food remain in the stomach, and during the slow process of digestion there comes on a sense of weight or uneasiness at the pit of the stomach, which gradually lessens, and at length ceases, as the food gets dissolved and passes out of the stomach. If any portions of the food remain solid, there is often, at

[1] The various forms of atrophy of the gland-structure of the stomach have been lately made the subject of careful microscopic examination by Dr. Handfield Jones; and I have much pleasure in referring the reader to his recently published work on the morbid conditions of the stomach, in which the results of his investigations are embodied.

the end of some hours, when the stomach is getting empty, a distressing feeling of spasm, or cramp, at the pit of the stomach.

Some experiments made by Dr. Beaumont on St. Martin seem to show that this feeling of cramp is owing to the undigested portions of the food getting into the pyloric orifice of the stomach.

Wishing to ascertain the temperature of the stomach during digestion, Dr. Beaumont passed a small thermometer into the stomach of St. Martin. When the bulb of the thermometer got into the narrow or pyloric end of the stomach, there was a forcible contraction of the stomach upon it, attended by severe pain and distress, like the cramp or the sensation frequently described as cramp by persons suffering from undigested food in the stomach. When the experiment was repeated several times in quick succession, it left a sense of soreness which was sometimes felt the following day.

If portions of food remain undigested many hours, they irritate the lining membrane of the stomach, and cause headache, a slightly furred tongue, and feelings of general disorder.

Not unfrequently this irritation of the stomach checks secretion in the liver, so as to render the complexion somewhat sallow; and in nervous persons who dine late it greatly disturbs the sleep.

When, from permanent weakness of the stomach, the digestion is habitually feeble, the body after a time is imperfectly nourished —the blood is poor in globules, the circulation is feeble, the extremities are apt to be cold, the spirits are depressed, and the various *powers* of the body decline. For great continued exertion, whether of body or mind, there must be a strong stomach and a large consumption of food.

The remedies for habitual slow digestion, in persons otherwise healthy, are to be sought in proper regulation of the diet and habits of life, and in medicines which tend to increase the secretion of gastric juice.

The diet should consist of food easily soluble, the stomach should never be overloaded, and there should be a sufficient interval between meals. Care should especially be taken to avoid new bread and tough meat, and not to oppress the stomach by malt liquors, or to indulge in fermented drinks of any kind beyond the point which, from habit or otherwise, the state of the nervous system may require. Bodily fatigue and nervous exhaustion should be avoided, as these states lessen the secretion of gastric juice; but mind and body should be sufficiently exercised. We were intended to be active creatures, and a life of indolence is the infraction of a natu-

ral law, which always brings a penalty of some kind or other. A certain amount of bodily exercise and agreeable occupation of the mind promote digestion and improve in various ways the general health, and contribute greatly to the preservation of both the bodily and the mental powers.

Various medicines—ipecacuanha, rhubarb, cayenne pepper—taken in small doses, stimulate the lining membrane of the stomach and cause a more abundant outpouring of gastric juice, and may often be taken with advantage just before the principal meals by persons who are troubled with slowness of digestion. For example, from half a grain to two grains of ipecacuanha and three or four grains of rhubarb, or a grain of capsicum with three or four grains of rhubarb, in a pill, may be taken before dinner, or before breakfast and before dinner.

Salt and mustard have an action on the coats of the stomach of the same kind. A large quantity of salt taken at breakfast will sometimes relieve the headache and much of the other discomfort that follows a debauch. Mustard, as is well known, promotes, with most people, the digestion of beef and other rich meats; and its habitual use will occasionally be found greatly to mitigate the discomfort that results from an habitual slow digestion. White mustard-seed, swallowed whole, was, indeed, some years ago, one of the popular remedies for indigestion; and I have met with more than one instance of aggravated indigestion in which much benefit was attributed to its use. It was given in the dose of a table-spoonful two or three times a day. These stimulants for the stomach—ipecacuanha, salt, mustard—when taken in considerable doses, are all of them powerful emetics. As a remedy for frequently recurring slowness of digestion, ipecacuanha seems to me to be more effectual than any of the others. The dose of it should, of course, be too small to cause a feeling of nausea.

The uneasiness of the stomach that arises from slow digestion may often be mitigated by drinking a small glass of water, or by eating a lump of sugar, an hour or two after meals or when the uneasiness begins to be felt.

Where digestion is habitually slow and feeble, much benefit of more lasting kind may frequently be derived from the muriatic or the nitro-muriatic acid, taken for some weeks together, half an hour or three parts of an hour before the principal meals.

I need hardly say that, when digestion is slow and feeble, care should be taken not to give at the time of meals, or while digestion

is going on, alkalies, the alkaline salts, or other medicines that suspend or enfeeble the action of the gastric juice.

When weakness of the stomach is congenital, and when it arises from an irreparable injury done to its gland structure, the chief relief from the ills it causes is to be found in suiting the diet to the power of digestion, and in measures that tend to improve the general health.

But mere slowness of digestion is not the only ill effect of a scanty or depraved secretion of gastric juice. It often happens when the stomach is weak and disordered, or when more food is eaten than the healthy stomach can readily master, and especially when at the same time it secretes an unhealthy mucus prone to ferment, that the undigested food in the stomach undergoes putrefactive changes or some unnatural fermentative process instead of proper digestion.

One of the most remarkable properties of the gastric juice is that of preventing the putrefaction of meat. Spallanzani first ascertained the fact, that gastric juice not only prevents the putrefaction of meat, but has the power to arrest the process of putrefaction already begun, and even to correct the fetor of meat already tainted. Later physiologists have ascertained that it likewise hinders the lactic, acetic, and alcoholic fermentations, which consequently do not occur in the stomach during healthy digestion.

But if the gastric juice be insufficient in quantity, or faulty in composition, this controlling power may be inadequate to its purpose, and the food in the stomach may undergo some fermentative changes that ought not to take place.

The precise nature and the products of these changes depend on the quality of the food and on the state of the substance that acts as a ferment. If this substance be decomposing mucus, as Lehmann has suggested that it commonly is, the kind of fermentation will very much depend on the stage of decomposition which this has reached.

In some cases, the food undergoes common putrefactive changes, and sulphuretted hydrogen is evolved. Distention and uneasiness of the stomach come on, with frequent eructation of sulphuretted hydrogen,—belchings as of rotten eggs. This is attended with severe frontal headache—often with a feeling of chilliness—and the other disorder familiarly known as the effects of surfeit. All this disorder is speedily removed when the stomach is emptied by a vomit.

This kind of indigestion is a common effect of over-eating, even

in young and healthy persons, and hence is popularly known as "a surfeit." Delicate and growing boys often eat largely from a sense of exhaustion, and soon afterwards engage in active play; the food is undigested, and surfeit occurs. It is more prone to occur in persons with carious teeth, when offensive saliva passes into the stomach.

It frequently occurs, too, as we have seen, in cancer of the stomach, where offensive secretions are poured into the stomach, while the food, in consequence of an obstacle at the pyloric orifice of the stomach or of some impediment to the free action of its muscular fibres, is unduly detained there.

When "a surfeit" occurs in a young and healthy person, the quickest and best way of removing the disorder is to give an emetic, and so free the stomach from the putrefying matter; and afterwards, if need be, to empty the bowels by some quickly-acting purge.

In malignant disease of the stomach, in which this kind of disorder is especially apt to occur, emetics, which irritate the lining membrane of the stomach and may cause violent efforts of vomiting, are unsafe, and an attempt should rather be made to prevent the disorder by proper regulation of the diet. As charcoal has antiseptic properties, toasted bread may be taken instead of plain bread, toast and water instead of plain water, or a small quantity of freshly burnt and powdered charcoal may be given with each of the principal meals. This may be conveniently prepared by pounding bread thoroughly charred; and as it is quite tasteless, may be taken suspended in tea, water, or any other liquid.

Should the disorder occur in spite of precautions such as these, the progress of the putrefactive changes may sometimes be stayed, and the further evolution of gas be prevented by small doses of creasote. From half a minim to a minim of creasote is sufficient, and may be given in a pill at the time of meals, or as soon afterwards as the putrefactive changes begin.

It much more commonly happens, when digestion is feeble, that the contents of the stomach undergo some other kind of fermentative process.

If the food have consisted chiefly of vegetables, fruits, new bread, ill-fermented malt liquors, new wines, it has a tendency to pass into a fermentation by which carbonic acid is freely evolved. This causes great distention of the stomach, and a distressing sense of uneasiness, frequently relieved for the moment by the eructation of inodorous gas—chiefly, carbonic acid gas.

If the stomach be emptied by a vomit, the rejected matter is seen to be in a state of active fermentation.

In the case of St. Martin, Dr. Beaumont had an opportunity of witnessing this process in the stomach itself. St. Martin had been in the woods all day, picking whortleberries, and had eaten no other food from seven in the morning to eight in the evening. Dr. Beaumont then looked into the stomach, and found it, to use his own expression, "full of berries and chemifying aliment, frothing and foaming, like fermenting beer or cider."

If food be eaten which is already in a state of fermentation, the fermentative process may continue in the stomach itself. When, for example, new wine is drunk,—wine that is in a state of fermentation,—the fermentation sometimes continues; is, perhaps, even increased by the heat of the stomach; and carbonic acid is evolved very rapidly. The stomach becomes greatly distended, and it is stated that the consequent disorder is sometimes so great as to destroy life. Cattle, when first placed in a field of fresh clover or other rich pasture, frequently eat more than their stomachs can digest. The vegetable mass ferments in the stomach, as it would at the same temperature out of the body, and carbonic acid and hydrogen (and sometimes hydrogen and sulphuretted hydrogen) are evolved in great quantity. In consequence of the peculiar structure of the stomach in cattle, these gases cannot escape through the œsophagus, and the stomach becomes enormously distended—in some cases even to bursting.

In man, the gas escapes readily through the œsophagus, so that, even when much of it is evolved, the immediate ill effects of this kind of indigestion are very rarely serious. In the course of a few hours the fermentative process is at an end, and the distention of the stomach subsides.

The cases in which medical advice is most frequently sought are, however, not those where distressing distention and flatulence result from mere over-feeding in healthy persons, but where this kind of indigestion in less degree is habitual, so that uneasiness of the stomach and flatulence are commonly felt an hour or two after the principal meals.

The ill effects of the disorder are, then, not confined to distention and uneasiness of the stomach. The fermentative processes in the stomach give rise to products which, when absorbed into the blood, have an injurious influence on the general health, and the frequent repetition of the indigestion prevents the proper nutrition of the

body. The patient is usually depressed in spirits, is less capable than in health of mental exertion, and has lost some of his customary energy and strength. It often happens that oxalic acid is one of the products of the unhealthy digestion, and that crystals of oxalate of lime may be found in the urine. In many such cases the indigestion itself results from a faulty state of the general health, or from overwork or depressing influences of other kinds, and the disorder belongs to a class to which I shall call your attention in a future lecture.

When thus arising, the flatulent distention of the stomach may sometimes be prevented by the pills composed of ipecacuanha and rhubarb, or capsicum and rhubarb, of which I have before spoken; but a remedy which succeeds more frequently is the nitro-muriatic acid—ten minims of each of the dilute acids twice a-day,—taken half an hour, or three quarters of an hour, before the principal meals.

Much good will result also from horse-exercise, change of air, and other influences which tend to improve the general health.

The diet should be light and nourishing, and the patient should eat sparingly of succulent vegetables, fruits, and saccharine substances in general, and should carefully abstain from ill-fermented malt liquors.

A more common kind of gastric disorder is one which seems to be owing to the lactic fermentation, by which the starchy principles of the food are rapidly converted in the stomach into lactic acid. This disorder is most common in nervous persons with feeble digestion, in whom it not unfrequently happens that acid collects in great quantity in the stomach after meals. They often familiarly tell us, that almost everything they eat turns to an acid. If vomiting occur an hour or two after meals, the matter thrown up is very acid, and, on analysis, the acidity has been often found to be mainly due to lactic acid.

It was supposed by Dr. Prout that much of the lactic acid which collects in the stomach in such cases is derived from the blood, and that it is secreted by the coats of the stomach. Whether this be so or not, there can be little doubt that it is often formed in great quantity in the stomach from the starchy principles of the food. It is possible that the secretion of lactic acid by the coats of the stomach may promote the conversion of the saccharine principles of the food into this substance.

This lactic fermentation is not, like the kinds of fermentation of which I have before spoken, attended with evolution of gas. It

causes, therefore, not flatulence, but heartburn and pain in the stomach, which is often very severe, and which is sometimes attended with a feeling of constriction or cramp.

The uneasiness that results from undue acidity thus arising may be relieved for the time by alkalies, and may often be prevented by giving, before meals, medicines which have an astringent or bracing effect on the coats of the stomach—bismuth and magnesia, or, better still, the mineral acids, especially the sulphuric acid.

Lactic acid, out of the body, is apt to undergo another kind of fermentation, which causes the slow evolution of hydrogen and carbonic acid, and which leads to the formation of butyric acid.

There can be little doubt that the same changes occasionally take place within the intestinal canal. Hydrogen is one of the gases that have been found in the intestines, and now and then the matter vomited by persons of weak digestion has the sour rancid smell of butyric acid.

I have spoken of several kinds of fermentation as if they existed separately; but it very commonly happens, although one kind may predominate and give a character to the disorder, that these several kinds, and others of which little is known, go on simultaneously, or rather perhaps in quick succession, in the stomach, and that various gases, carbonic acid, hydrogen, and sulphuretted hydrogen, and various acids, lactic, butyric, etc., are formed. The consequent disorder is not confined to the stomach. The acid and unnatural products of digestion may pass into the bowels, fret their lining membrane and excite griping pain and purging; some noxious matters may be absorbed, and cause headache and other disorder; and, if the indigestion recur frequently, the general health must suffer.

Severe attacks of vomiting and purging, commonly designated English cholera, seem often the result of fermentation or putrefaction of food in the stomach, by which some highly-irritating matter is formed. If I may judge from my own experience, such attacks generally come on in the evening, soon after dinner, or at night, soon after supper, and are much more frequently consequent on a meal of meat or cheese, than on the eating of fruits, to which, perhaps from the greater frequency of the disorder in autumn, they are generally ascribed. I have found no remedy so effectual in checking the disorder as pills composed of creasote and opium.

Our knowledge of the various kinds of fermentation is still very imperfect. As it becomes more extensive and exact, our knowledge of various forms of indigestion will, doubtless, become more precise, and our power of relieving them greater than it now is.

LECTURE XI.

Fermentation in the contents of the stomach, with development of sarcinæ.

THE consideration of the preceding kinds of fermentation leads us naturally to that particular kind in which those curious bodies, the *sarcinæ ventriculi*, are formed in the stomach.

These bodies were first discovered by Mr. John Goodsir, in 1842, in a case of which he has given the following account.

"Mr. ——, aged nineteen, consulted me about a stomach complaint, under which he had been labouring for four months, and which had more or less resisted every attempt made for its removal. He informed me that he considered it to be water-brash; that it attacked him on awaking in the morning with a feeling of distention of the stomach; that, without any effort of vomiting, a quantity of fluid, varying in volume from two-thirds to a whole wash-hand basinful, passed up from his stomach; that, after this, he was quite relieved, and experienced no further inconvenience till the evening of the same day, when, without decided distention, sounds as of a fluid boiling or bubbling, and proceeding from the region of his stomach, were perceptible to himself and to those around him; that he slept well enough, but was generally attacked in the usual manner next morning. Such was my patient's own account of his case.

"On examining more particularly into the symptoms, I could ascertain nothing positive. His tongue and pulse were natural; he had no headache, nausea, or thirst; no tumour could be detected in the epigastrium, and no pain on pressure was complained of in the region of the stomach. The bowels were moved daily, and the stools were normal. His appetite was not affected, and the usual articles of diet appeared to agree with him. He was thin, but had a good complexion, and his flesh was firm. He stated that he had been very fat, but that this had left him before the accession of his stomach complaint.[1]

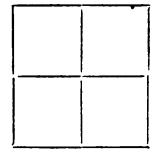
The fluid thrown up from the stomach smelt, Mr. Goodsir adds, like fermenting wort, with a faint acid odour; and, after it had

[1] "Edinburgh Medical and Surgical Journal," vol. lvii. p. 430.

stood a few hours, was covered with a mass of froth, like the head of a pot of porter. The fluid itself was then moderately transparent, and of a light brown colour, and had deposited on the bottom of the basin a ropy matter of granular appearance.

Mr. Goodsir proceeded to examine the fluid under the microscope, expecting, from the signs of fermentation which the matter presented, to see some of the globular or moniliform algæ, which are the usual concomitants of certain fermentations. "What," he says, "was my astonishment then to find, in the first drop I examined, not the vegetables I was led to expect, but numerous individuals of a form with allies of which the zoologist is familiar! Drop after drop exhibited the same specific form, with a precision which convinced me that I had now to deal with an organism which, whether animal or vegetable, was closely allied to certain genera of *bacillariæ*, and much more closely to the genus *gonium* among the *volvocinæ*."

These organisms—the sarcinæ—are square or slightly oblong plates, the thickness of which is about one-eighth of the length of one of the sides. They are divided into four equal squares by lines, which join the middle points of opposite sides and cross at right angles in the centre of the face, so as to resemble a packet bound with cords which cross at right angles.



Each of the four secondary squares is again divided into four ternary squares, which are similarly arranged, but more faintly marked.

Perfect individuals vary from the 800th to the 1000th of an inch in the length of their sides, and under a high power appear slightly brown or yellow.

After discovering the sarcinæ, Mr. Goodsir submitted some of the fluid to Dr. George Wilson, who made an elaborate analysis of it, and found that it contained a large quantity of acetic acid, some acid which he inferred to be the lactic, and a minute quantity of hydrochloric acid.

The patient was under Mr. Goodsir's observation nearly two months, at the end of which the disorder still continued, but had been much mitigated by the remedies employed.

Soon after the observations of Mr. Goodsir were published, sarcinæ were found by Mr. Busk in three cases in quick succession.

The first case was that of a young man who was admitted into the Seamen's Hospital for severe injuries, and who, previously to the infliction of these injuries, had been in perfect health. He had

sustained rupture of the diaphragm, in consequence of which the whole of the stomach and parts of other abdominal viscera had passed into the cavity of the left pleura. After his admission to the hospital, he lived about eight days, during which time everything he swallowed was brought up again by a kind of regurgitation, apparently without having entered the stomach at all. Besides the mere *ingesta*, a peculiar-looking brown fluid was occasionally thrown up in large quantity,—to the amount, in the course of twenty-four hours, of several pints. On being allowed to stand for twenty-four hours, this fluid underwent fermentation, had a faint odour, something like that of fermenting wort, and was covered with a yeasty froth.

On examining the brown matter through the microscope, Mr. Busk found that it was composed almost wholly of sarcinæ and of small bodies like the torulæ of yeast.

The second case was that of a young man with fracture of the spine and, as was supposed, rupture of the diaphragm,—the result of a fall into the hold of a vessel. About twelve hours after the accident he vomited once, and once only; and the matter rejected consisted of a small quantity of brownish fluid, mixed with food. The brown colour, as in the former case, was found to depend upon the presence of coloured flakes, composed in the greater part of sarcinæ.

This man never vomited afterwards, and at the end of several months was in perfect health, excepting the paralysis and other effects of the injury done to the spine. His appetite and digestion were very good.

The third case related by Mr. Busk was that of a boy, about fifteen years of age, who was much reduced by disease of the hip-joint, from which he had long suffered. A short time before his death, he was seized with acute pleurisy, which was attended with frequent vomiting, and in the matter thus rejected, and consisting of little more than mucus, were observed many brownish flakes, which were found to be composed principally of sarcinæ.

Nothing peculiar was observable in the mucous membrane of the stomach in this or in the first of the cases related by Mr. Busk; nor were any of the sarcinæ to be detected, on the most careful examination, in any other part of the alimentary canal than the stomach. ("Microscopical Journal," vol. ii., p. 321.)

In the winter of 1850, two men having this peculiar form of indigestion were in the hospital together, and were long under my observation.

One of them, James Lane, was a labourer, forty-four years of age, and the stomach disorder, as in two of the cases recorded by Mr. Busk, seemed to have resulted from an injury. He told us that he had led a temperate life in the country and that his health was good until two years before, when, while he was at work on a railroad, a large quantity of earth fell upon him, throwing him with violence across some pieces of thick board. He was completely buried in the earth for half an hour, at the end of which he was dug out insensible, and was found to have received some severe injuries of the head and face. Ever since this accident he had experienced palpitation and shortness of breath on exertion, so that he had been unable to work hard, and his stomach had been disordered in the following way. As soon as he recovered from the immediate shock of the injury, he began to suffer pain at the stomach. The pain continued, and from that time he had occasional vomiting; but the vomiting did not trouble him much until the last four months, during which it had occurred, on an average, two or three times in twenty-four hours. The vomiting occurred most frequently in the evening or at night after he had gone to bed.

On his admission to the hospital, on the 11th of December, he was thin, and much out of condition. His appetite was good, but a few minutes after every meal he had pain and a sense of burning at the pit of the stomach, soon followed by much flatulence and distention of the stomach, which continued until he vomited, when the stomach got slack and the heartburn ceased. The matter vomited varied in quantity, from a teacupful to a quart or more. It was always sour, and, after it was vomited, fermented and frothed like wort. When it had stood some hours in the vessel in which it was received, it consisted of a clear liquid, which had a brownish sediment and was covered by a light-brownish frothy matter that looked and smelt like yeast. He stated that the stomach was usually emptied by four or five efforts of vomiting—that a clear liquid-like water came first; a thicker and brownish matter last.

On microscopic examination, the brownish matter was found to contain great numbers of the yeast-fungus and sarcinæ.

Lane complained of pain at the right of the epigastrium, and was unable to lie on the right side, as this posture increased the pain and uneasiness at the stomach and the flatulence. On account of this pain, several blisters had been applied between the right mamma and the epigastrium. At a small spot under the cartilage of the tenth rib on the right side there was constant tenderness, but no

tumour could be felt there. The stomach appeared to be somewhat enlarged, and the bowels were habitually costive. It seemed probable that the diaphragm had been injured, and that the movements of the stomach were impeded by unnatural adhesions of the stomach near its pyloric end.

Lane was quite free from fever, but his nights were often restless from the uneasiness and distention of the stomach, which were usually most troublesome in the evening and at night.

He was kept on a diet of lean meat and bread, and was ordered to take two minims of creasote in pills three times a day. Under this treatment the symptoms abated; and on the 15th of January, five weeks after he came under our notice, he left the hospital much improved in condition, but still suffering from pain at the epigastrium, flatulence, and the occasional vomiting or eructation of a sour fermenting liquid.

I sent the liquid vomited on two different occasions to the Laboratory of the College, and requested Mr. Hardwick to analyze it for me, and to ascertain especially what acids were in it, and whether it contained alcohol. He complied with my request, and the result of his analysis was, that the first specimen contained acetic acid and a trace of hydrochloric acid, but no alcohol; the second specimen, acetic acid, but neither hydrochloric acid nor alcohol.

The result of the analysis confirmed, therefore, that made by Dr. Wilson, that the acid generated by the fermentative process is acetic acid.

In the "Medical Times" for the 23rd of August, 1851, Dr. Jenner has published some very valuable and interesting observations on the case of a man who had suffered terribly for many years from the kind of stomach disorder we are considering. In this instance, an analysis of the matter vomited was once made by Professor Graham, who found that "it contained a large excess of free hydrochloric acid, a little acetic acid, alcohol, and sugar. The gas disengaged was carbonic acid."

Similar results seem to have been obtained by Dr. Bence Jones, from analyses of fluid containing sarcinæ vomited by a man in St. George's Hospital.

It is probable, therefore, that in the fluid vomited by Lane and analyzed by Mr. Hardwick, alcohol was present at an earlier stage of the fermentative process, but that by the time the analysis was commenced this had all passed into acetic acid.

It occurred to me, that it might be possible to generate the sar-

cinæ from some materials of the food out of the body; and with the assistance of Dr. Jordan, the physician's assistant at the hospital, I made the following experiment:—

A small quantity of the brownish matter containing torulæ and sarcinæ, vomited by Lane, was added, in separate glasses,

1st. To sugar and water.

2ndly. To starch and water.

3rdly. To albumen (white of egg) and water.

4thly. To a mixture of the contents of the three preceding glasses.

The fluid in these several glasses was kept for two or three days at the temperature of the body; but in not one of them were the sarcinæ multiplied. I did not then know that an acid condition of the fluid is essential to their development, as M. Andral and Dr. Hassall have shown that it is to the development of some other fungi.

On the 14th of December, 1850, three days after the admission of Lane to the hospital, another man, Joseph Burraston, was admitted, thin and out of condition, like Lane, and having a stomach disorder of the same kind.

Burraston, who was forty years of age, was a pot-cleaner at a public-house in London, and had drunk very hard of beer and spirits. He had suffered in years gone by from syphilis and gonorrhœa: but, with the exception of these diseases, his health seems to have been good, considering his habits, until about twelve months before his admission to the hospital, when he began to have occasional sickness, especially after drinking beer or spirits.

Six months before his admission the vomiting became more frequent; and since that time he had sometimes vomited twice or thrice in a day. The appetite was always very good. He suffered no positive pain in the stomach, but soon after meals had a burning heat there, and the stomach became blown out with wind. The uneasy sensations continued until vomiting occurred, when they ceased, to be excited again, in greater or less degree, after the next meal. The matter vomited often amounted to a pint and a-half, and sometimes to two or three pints. It usually consisted of a sour clear liquid, having a light brownish stringy sediment. It fermented, and after a time became covered with a brownish froth, like that on the top of fermenting wort. The brown matter, both in the sediment and at the surface of the liquid, contained abundance of the yeast-fungus and sarcinæ.

No tumour could be felt at the epigastrium, but the bowels were habitually costive and the stomach appeared to be larger than natural.

The long duration of the malady, the habitual constipation, and the apparent enlargement of the stomach, led me to infer, that the pyloric orifice of the stomach was somewhat strictured; and it seemed probable, from there being no tumour and no positive pain—from there being, in fact, no indications of cancer of the stomach or of simple ulcer—that the cause of the stricture was that induration of the cellular tissue in the pyloric ring which spirit-drinking causes.

Burraston remained in the hospital till the 29th of March—between three and four months. During all that time he was quite free from fever; the pulse usually ranging from 56 to 80 a minute. The appetite was constantly good, sometimes more craving than natural. The condition of the stomach varied according to the remedies employed. Sometimes, although there was more or less flatulent distention and sense of burning in the stomach after meals, there was no vomiting for many days together. At other times, vomiting occurred two or three times a-day. The distention and uneasiness of the stomach were usually greater, and the vomiting was more frequent in the evening and at night, than in earlier parts of the day. The matter vomited was always the same kind of glairy fluid, and was almost always acid and fermenting. On two or three occasions, however, the fluid was alkaline; and it was observed, that when such was the case, no sarcinæ could be found in it. The same fact was noticed in a man who was some months before in the hospital under the care of Dr. Todd.[1]

The sleep seemed to depend mainly on the state of the stomach; being sound when the stomach was empty, and disturbed and broken when the stomach was distended and uneasy. The urine was always clear, and usually very acid. The quantity of it passed daily varied from a pint and a-half to three pints and a-half in twenty-four hours, and the specific gravity ranged from 1022 to 1011: the larger quantities within this range and the lower specific gravities being by far the more common condition. The urine contained no albumen, but often exhibited under the microscope crystals of oxalate of lime. It was frequently noticed that the saliva had an acid reaction.

Various plans of treatment were tried in succession.

[1] On one occasion, in 1849, I found sarcinæ in a fluid which was neutral. The fluid, which had been vomited by a man in King's College Hospital, had a light-brown foam on the surface and a light-brown viscid matter at the bottom—both containing sarcinæ. The liquid did not redden litmus-paper; but when this paper was pressed on some of the light brown matter from the top or bottom, it was distinctly reddened.

At first, two minims of creasote were given three times a-day, in pills, as in the former case; and, in order to obviate constipation, five grains of the compound aloetic pill at night.

Under these remedies considerable amendment took place, so that three or four days were sometimes passed without vomiting; but the peculiar disorder of digestion always existed in greater or less degree, and, at times, the distention of the stomach was as great, and, if vomiting occurred, the matter thrown up was in as large quantity, and had the same characters as before.

On the 16th of January the creasote was left off, and, on account of the frequent presence of oxalate of lime in the urine, twenty minims of the dilute nitro-muriatic acid were given twice a-day, half-an-hour before the principal meals.

At the end of a week, no benefit having resulted from the acids, the creasote was again given instead, and a diet was ordered from which saccharine substances were excluded, and which comprised a pound of lean meat, eighteen ounces of gluten bread, and two pints of coffee. The disorder again abated.

On the fifth of February it is noted that he had gained 3½ lbs. in weight in the previous week. On the evening of that day, however, he vomited three pints of matter, which was as sour as the matter vomited before, and fermented as much. From this time, though there was always more or less distention and uneasiness of the stomach after meals, he did not vomit till the 19th, when he again brought up three pints, having the same characters as before. On this day his weight was 8 stone 10 lbs., exactly as it was on the 5th of February, a fortnight before.

It then occurred to me, that, as the disorder seemed to be kept up by some obstruction at the pyloric end of the stomach, good might possibly result from occasionally emptying the stomach completely, and thus getting rid of the ferment by means of emetics: and, in consequence, I ordered him to take occasionally one scruple of sulphate of zinc. The emetics acted very powerfully, but no essential benefit resulted from them.

The medicines he had hitherto been taking were now left off, and five grains of nux vomica were given in pills three times a-day. These pills were taken more than a week without apparent benefit. On the 10th of March they were discontinued; and having learned from a man who was some time before in the hospital vomiting sarcinæ that he had derived much benefit from eating large quantities of common salt, I prescribed this, as a medicine, to Burraston.

From tbe 10th of March to the 19th he took two tea-spoonfuls, and after the 19th two table-spoonfuls of common salt, in half a pint of water, twice a-day. Together with the salt, he occasionally took, as before, compound aloetic pills, to regulate the bowels.

This remedy proved much more successful than any previously tried. After he took the large doses of salt, he had occasionally a sense of burning in the stomach and more or less of distention; but did not vomit and had very little nausea; and on the 29th of March, three weeks after the salt was ordered, he left the hospital much relieved.

On the 8th of October of the same year, the nurse at the hospital under whose charge he was, showed me a letter she had just received from him, in which he stated that ever since he left the hospital he had continued to take the salt, and that for some time he had also taken habitually cascarilla tea. His stomach disorder, he stated, was very much less troublesome than when he was in the hospital, and he attributed the amendment mainly to the salt.

In the autumn of 1851, I was consulted at my own house by a man who had suffered from this kind of stomach disorder for ten years, and who had derived great relief from enormous doses of carbonate (bicarbonate?) of soda. He was a carpenter, forty years of age, who lived in the country, and had always, as he stated, been of temperate habits. The stomach disorder came on without assignable cause, and slowly but gradually increased. He told me that four years before I saw him, a chemist had recommended him to take carbonate of soda, and that he soon got to take enormous quantities of it; for months together as much as three-quarters of a pound a week—on his bread, and in his tea and beer—and sometimes, for a short time, as much as a pound a week. For the last four months his allowance had been a quarter of a pound a week, and he had found that a larger quantity of it gave him pain in the back. He stated that at first he derived great benefit from these large doses of soda, and that they enabled him to resume his work, which he had been obliged to discontinue before. His strength, however, had gradually declined, and when I saw him he was much emaciated, and had the look of a man with malignant disease. No tumour could be felt in the region of the stomach, but the stomach was much distended; the bowels were habitually very costive; the cutaneous veins of the belly were large; vomiting occurred frequently, sometimes as often as two or three times a day, and several times within the preceding two years he had vomited matter like coffee-grounds.

His symptoms differed from those of the patients of whom I have before spoken, in the circumstance, that solid food gave him pain in the stomach, so that he had been induced to refrain almost entirely from its use.

It was plain that at the time I saw him there was obstruction of the pyloric orifice, and it seemed probable that this was the effect of slowly-growing malignant disease.

I prescribed at first large doses of salt, but no benefit resulted from them; and I subsequently ordered, I know not with what effect, bismuth, magnesia, and opium.

He lived till towards the end of 1853, and on *post-mortem* examination of the body it was ascertained, as was subsequently reported to me, that the malady consisted in simple stricture of the pylorus—so complete that a probe could scarcely be passed through. There was no thickening nor any other indication of malignant disease, and every other organ of the body was sound.

It appears from the preceding cases, and many similar ones on record, that the peculiarity of disorder we are considering consists in this, that the secretions of the stomach, which seem to be usually more abundant than natural, undergo or excite in the food, in the stomach and after they have been thrown up from it, a fermentation which is attended with the evolution of carbonic acid and with the production of torulæ and sarcinæ, and which leads to the formation of acetic acid.

The production of the disorder seems to require that there shall be some condition which prevents the stomach from completely or readily emptying itself.

The disorder may occur in young persons, and exist for a short time, as in one of the cases related by Mr. Busk, and in a case that has been recorded by Dr. Bence Jones, in which it was noticed a short time before death in a boy of fourteen, who died of peritonitis and granular disease of the kidney; but it has been most frequently noticed in men who have reached middle age,—persons more liable than any others to simple stricture and cancer of the pylorus and to other diseases which prevent the stomach from completely emptying itself,—and in such persons the malady is usually of long duration and may, indeed, continue to the end of life.

The appetite is generally good, but the indulgence of it is followed by flatulent distention of the stomach, attended by a sense of burning or other uneasiness, which, when an ulcer of the stomach exists, sometimes amounts to almost agonizing pain. When the

disorder is slight, the heartburn or uneasiness at the stomach continues for some hours, and then gradually subsides, as—in one way and another, by the absorption and discharge of its contents,—the stomach gets empty. When the disorder is in higher degree, the uneasiness persists until it is relieved by the vomiting or eructation of a clear, sour, fermenting liquid. The quantity of this liquid ejected at once varies in different cases and at different times; and when an obstruction at the pyloric orifice has long existed and the stomach has become much enlarged, sometimes amounts to two quarts or more. When much is thrown up from the stomach, the bowels, as in ordinary cases of stricture of the pylorus, are usually costive. There is, in most cases, complete absence of fever, but sleep is often much disturbed by the distention and uneasiness of the stomach, which, as they result from eating, are more distressing in the evening and at night than in earlier parts of the day.

The disorder of digestion, the pain, the disturbance of sleep, cause loss of flesh, and, after the malady has lasted long in high degree, the patient is usually emaciated, has a dry skin, a slow pulse, and the look of a person with serious organic disease of the stomach. The disorder is readily recognised when it is in such degree as to cause vomiting, by the circumstance, that the matter thrown up from the stomach ferments, and that both the foam which collects on its surface and the sediment it throws down contain abundance of sarcinæ and torulæ.

It would seem, from the evolution of carbonic acid, from the development of torulæ, and from the fact, that alcohol was detected by Professor Graham in the matter vomited in a case of this kind, that common alcoholic fermentation is the first step in the process of transformation; but the alcohol appears to be rapidly transformed, and the process ends in the production of a large quantity of acetic acid. No symptoms of intoxication have been noticed in cases of this kind.

As the production of acetic acid from alcohol requires a large quantity of oxygen, there can be little doubt, that where, as in the analysis published by Mr. Goodsir, a very large quantity of acetic acid has been found in the matter vomited, much of this acetic acid has been formed after the matter has been ejected from the stomach. We know that fermentation goes on actively in the matter ejected, and the conditions for the acetification of alcohol would seem to be much more favourable when the matter is exposed to the air than when it is shut up, excluded from the direct influence of the air, in the body.

It must not be supposed, however, that this peculiar fermentation constitutes the whole disease. The disease consists primarily and essentially of some organic change which prevents the stomach from completely or readily emptying itself, and which causes a secretion from the coats of the stomach which, when mixed with the food, is prone to undergo or to excite the fermentative process in question. The fermentation may be stopped for a time; the matter thrown up from the stomach may be alkaline, and contain no sarcinæ, as happened to Burraston during his stay in the hospital; but the patient, instead of being then well, has the more common kind of disorder which an impediment to the emptying of the stomach causes. The question then arises,—How is it that an impediment to the emptying of the stomach leads to this kind of fermentation in some cases and not in others? Is there any peculiarity in the organic change in the particular cases in which the fermentation occurs? It is curious that, in two of the cases related by Mr. Busk, the disorder resulted from hernia of the stomach through the diaphragm, the coats of the stomach itself being sound.

The development of the sarcinæ has probably the same relation to the fermentative process, or to some stage of the fermentative process, as the development of torulæ has to simple alcoholic fermentation. It is worthy of note that sarcinæ are not peculiar to the stomach. They have been found in other animal secretions in a state of decomposition. In a review of Lehmann's "Physiological Chemistry," in the *British and Foreign Medico-Chirurgical Review* for 1851, it is stated that sarcinæ have been once detected in the urine by Heller; and Dr. Beale tells me that he has discovered them once in urine and once in decomposing bile.

But, although the development of torulæ and sarcinæ cannot be considered the primary cause of the stomach disorder, the fermentation that attends it, by leading to the evolution of gas and the formation of acetic acid, and thus distending and fretting the stomach, terribly aggravates the sufferings which the impediment to the emptying of the stomach, which is the origin of the mischief, would otherwise produce.

The heartburn and uneasiness of the stomach may be lessened by neutralizing the excess of acid by carbonate of soda or some other alkali; but the readiest, perhaps, in most cases, the chief means we have of relieving the disorder, are the agents which tend to prevent the fermentative process. The fermentative process may be checked by creasote, which has a remarkable influence in checking fermen-

tation of various kinds, and which was given with benefit in three of the cases noticed above, and in several others of which accounts have been published in the medical journals. A small dose—a minim or half a minim—in the form of pill, might prove sufficient if taken, as it should be, at every meal.[1]

If we may judge by the case of Burraston, the fermentation may also be checked, and the disorder, in some cases, be much mitigated by large quantities of common salt.

A more effectual remedy still is the bisulphite of soda, which is a powerful antiseptic, and has been of late years much used in some anatomical schools to preserve bodies for dissection. It has also been used to prevent the fermentation of vegetable juices. It owes its virtues to the circumstance, that it is decomposed by almost any vegetable acid, and that its decomposition liberates sulphurous acid, which has great power to prevent alcoholic and acetous fermentation.[2]

The merit of suggesting it as a remedy for the disorder we are considering belongs, I believe, to Dr. Jenner, who gave it with much success in the case to which I have before referred. I have myself given it with great benefit in several cases in which the symptoms were like those that attend the vomiting of sarcinæ, and in many other cases in which much discomfort resulted from the development of gas in the stomach. From fifteen grains to a drachm of it may be given, dissolved in water, two or three times a day; and with proper care as to the time of giving it, smaller doses will often prove sufficient. It is very soluble, and as it is not kept by all druggists, my custom is to prescribe a solution of it of the strength of two drachms of the salt in an ounce of water, and to order a teaspoonful of this to be taken in a wineglass of water soon after meals, or when the fermentative process in the stomach is about to commence. I have given it in these doses without intermission for a considerable time, with much benefit to the stomach disorder and without any apparent ill effects.

There are, perhaps, many other agents having power to prevent fermentation, that might prove beneficial in the same way.

In chronic cases of the disorder, the drain from the coats of the stomach, and the frequent throwing up of part of its contents, causes

[1] In the new mode of preparing vinegar from alcohol, by making the alcoholic liquid frequently strain through twigs or shavings, it is found that any charring of the twigs or shavings entirely prevents the acetification of the liquid.

[2] In some parts of Devonshire, sulphurous acid generated by the burning of sulphur is used to arrest fermentation and prevent acetification in cider.

constipation, and it is requisite to obviate this condition, since any undue accumulation in the bowels aggravates the stomach-disorder. The best aperients are probably aloetic or colocynth pills.

When the disorder is severe and the patient reduced in flesh, opiates, timely administered, are of much service in lessening the uneasiness of the stomach and promoting sleep.

It now and then happens, that the disorder co-exists with chronic ulcer of the stomach, and that eating solid food causes *pain* in the stomach, which is different from the uneasiness that results from distention of the stomach, and pain also in the corresponding part of the back. In such cases, as in ordinary cases of simple ulcer, the diet should be of the least irritating kind.

By the various means which I have now enumerated, the disorder may be greatly mitigated, the strength of the patient kept up, and his life prolonged—which is as much as can be promised for any disorder which originates, as this usually does, in irremovable organic changes.

LECTURE XII.

Indigestion arising from defective action of one of the excreting organs, or from some fault in the nutritive processes in other parts of the body.

THE stomach is influenced in its action not merely by the state of the nervous system, but also by the state of the blood, and so, indirectly, by the various conditions that affect the nutritive processes in the body.

If the blood be rendered impure by defective action of one of the excreting organs, or by improper food, or by any fault in the assimilating processes, the secretions of the stomach are generally insufficient or unhealthy, and indigestion in some form or other, results.

I shall speak first of the disorders of digestion that result from defective action of the excreting organs.

The stomach is in more direct relation with the liver than with any other important excreting gland. The stomach and the liver are parts of the same great apparatus, whose office it is to supply, from the crude matters taken as food, fit material for the sustenance of the body. The action of the one organ is in some degree complemental to that of the other. Dr. Prout long ago advanced

the opinion, that the muriatic acid of the gastric juice is furnished by the decomposition of chloride of sodium or common salt, and that the soda thus set free in the blood is eliminated with the bile. He was early led to the opinion, which the researches of Matteucci, Liebig, and others, tend in some measure to support, that the principal digestive organs constitute a kind of galvanic apparatus, of which the mucous membrane of the stomach may be considered the acid, or positive pole, and the hepatic system the alkaline, or negative pole.

Dr. Bence Jones has lately shown, that soon after meals, when the stomach secretes a large quantity of muriatic acid, the urine has a tendency to become alkaline; and that the soda set free on the decomposition of the chloride of sodium which furnishes the muriatic acid of the gastric juice, instead of being all eliminated by the liver, as Prout seems to have supposed, is in part eliminated by the kidneys. Other observers have shown that, when the stomach is pouring out a large quantity of acid, the alkalinity of the saliva likewise increases; and, since the increased alkalinity of the urine and saliva at such times results from the increased quantity of free soda in the blood, it is probable that the same law holds for all other secretions of which soda is an essential constituent. But still there is reason to believe that the opinion advanced by Prout is in part true, and that an intimate relation—and one, probably, of the kind which Prout supposed—exists between the secreting functions of the stomach and the liver.

If the secretion of the liver be defective in consequence of deficient power in the organ, or in consequence of the congestion of it that results from high living and indolent habits, the functions of the stomach are almost invariably disordered, and in conjunction with a slight yellow tinge in the conjunctiva and skin, there is a coated tongue, an impaired appetite, nausea and especial disrelish of rich dishes, constipation; and often, with this defective action of the stomach and liver, there is disturbed or unrefreshing sleep, and great depression of spirits.

The remedies for this condition are, a light and simple diet, with water for drink; fresh air; exercise, to promote perspiration, without fatigue; and medicines that increase the secretions of the liver, bowels, and kidney. A moderate dose of blue pill, repeated two or three times on alternate nights, and a drachm of sulphate of magnesia in infusion of senna every morning, answers well for persons strong enough to bear it. To others, fifteen grains of bicarbonate

of soda twice a-day, with enough of the potassio-tartrate of soda to act gently on the bowels, or some other medicine of similar action, may generally be given with advantage.

Again, when the kidneys imperfectly perform their office, so that urea and other constituents of the urine contaminate the blood, the functions of the stomach are generally more or less disordered.

This is especially seen in advanced stages of Bright's disease, when the kidneys are atrophied. The prominent symptom of the stomach-disorder in such cases is nausea or vomiting. The vomiting is sometimes so frequent as greatly to interfere with nutrition, and is the only disorder of stomach complained of. In other cases, the ordinary effects of slow and feeble digestion—a sense of weight and oppression after meals, with flatulent distention of the stomach or undue acidity—co-exist with the nausea or vomiting; and sometimes these effects of slow and feeble digestion exist alone.

In chronic granular disease of the kidneys there are several conditions which tend to disorder the functions of the stomach.

First, there is, perhaps, in many cases, as when the kidney is irritated by a calculus, a purely nervous influence starting from the kidney, which is reflected upon the stomach and tends to derange it.

In the next place, the gastric juice becomes vitiated by admixture with urea, and probably with other hurtful excrementitious matters. The mucous membrane of the stomach must, as I have before observed, be regarded as an expanded gland, destined to furnish abundant secretions, and, by virtue of its active secreting function, occasionally instrumental in eliminating noxious principles from the blood. It has been found, indeed, on chemical analysis, that, in malignant cholera, and in those diseases of the kidneys in which the secretion of urine is very defective, the matters vomited contain urea, or the muriate or carbonate of ammonia derived from the decomposition of it.

The elimination of these foreign matters, or the reflex nervous influence, may, moreover, excite the secretion of gastric acid when there is no food in the stomach to dissolve; or may cause congestion of the stomach, and thus lessen the supply of gastric juice: or may lead, directly or indirectly, to an inflammatory condition of its lining membrane, and so not only lessen the supply of gastric juice, but also cause a secretion of unhealthy mucus, which from its proneness to ferment, is an additional source of gastric disorder.

I have already observed, when speaking of the effects of arsenic, that a stomach-disorder caused by some noxious matter in the blood

is apt, if it exceed certain limits, to be followed by an analogous disorder of the bowels. The cause of disturbance acts alike, though in different degrees, on the different parts of the intestinal canal. An illustration of this is seen in granular disease of the kidney, in which diarrhœa not unfrequently co-exists or alternates with the gastric disorder, and in which the matters voided by the bowels, as well as those ejected from the stomach, have been found to contain urea.

In granular disease of the kidney, the blood is always impoverished, and there is a source of further exhaustion in the abiding drainage of albumen from the system. It is very important, therefore, to remedy the disorder of digestion, and so, in the greatest possible extent, to supply the waste. Not unfrequently, indeed, more relief can be given by remedying the stomach-disorder than by any measures in our power that directly affect the kidney itself.

The vomiting or nausea may generally be controlled by the dilute hydrocyanic acid, which may be given in doses of four or five minims three times a-day, and which may be conjoined with small doses of potash or soda, if any indications of undue acidity likewise exist.

Another remedy, very effectual in controlling the vomiting, is creasote, of which a minim or less may be given, in a bread-pill, three times a-day, before meals.

If these means should fail, the vomiting and much of the associated gastric disorder may often be stopped for a time by a few purgative doses of cream of tartar and jalap, which probably relieve the stomach by causing a more abundant elimination of the noxious matter by the bowels. This medicine is best given, as are most others of similar action, in a single dose sufficient for the desired object, in the morning before breakfast, since it will then, in addition to the drain it causes from the mucous membrane, only sweep away the refuse of digestion, whereas if it be given at other times or in repeated doses during the day, it sweeps away food that has been more or less digested, but the nutritious elements of which have not been absorbed.

I need hardly remark, that when such impediments to healthy digestion exist, very great care should be taken in diet. If the food be hard of digestion, or if more be eaten than the stomach can easily dissolve, it not only oppresses the stomach and causes much temporary discomfort, but may excite an inflammatory condition of the mucous membrane, and thus still further weaken the digestive power.

The blood may be rendered impure and the stomach be deranged, not only by defective action of the great excreting organs, but also from fault in the processes concerned in the waste and repair of the tissues in other parts of the body. The blood is the storehouse from which the different textures of the body draw the materials for their nourishment and growth. Physiology teaches us that the organic constituents of most of the textures of the body are being constantly renewed—that, as time flows on, although the form remains nearly the same, the matter is changed. Every exercise of power causes an expenditure of the substance of the organ that ministers to it. Some constituent of the organ is resolved into simpler chemical compounds, which are then given back to the blood, and the blood furnishes to the organ fresh materials to supply the waste. There is thus a constant interchange between the blood and the tissues; the organic constituents of the tissues waste —are resolved, that is, into simpler chemical combinations,—and are then absorbed into the blood, and thrown off by the different excreting organs; and the elements of the tissues thus taken away are reconstructed out of fresh materials supplied by the blood. These processes of waste and repair are what have been termed the processes of secondary assimilation. It is essential to the purity of the blood that they be rightly performed. There are several ways in which they may be deranged. The expenditure of power may be too great, the tissues may waste too rapidly, and thus more effete matter may pass into the blood than the excreting organs can remove; or, without this, either in the waste or in the reconstruction of the tissues, some substances may be formed, and may pass into the blood, which are difficult of excretion, or which disorder the action of other organs.

It was Dr. Prout who fixed our attention on this great class of disorders—disorders not depending on any visible structural change, but on some fault in those subtle processes that minister to nutrition. There are, doubtless, more disorders of this class than we have yet distinguished. They all lead to an unnatural state of the blood, from the excess of effete matter or from the presence of some unnatural and injurious principle in it; and often this leads again to an unnatural state of the urine—the great drain through which the soluble effete matters of the body are cast off.

These states of faulty assimilation are then, in some instances, revealed to us by the condition of the urine.

One of the most important of them, as far as digestion is con-

cerned, is that characterized by the formation of lithic acid in undue quantity, and in which an excess of this substance exists habitually or frequently in the urine.

This particular derangement of the nutritive processes often has its origin, as you know, in a peculiarity of constitution—the so-called lithic diathesis,—which is permanent, and which is especially frequent in the members of gouty families and in persons of middle age who lead the kind of life that conduces to gout,—who eat, that is large quantities, of animal food, and drink freely of malt liquors.

In such persons, occasional indigestion is very common—indigestion marked chiefly by excessive acidity of the stomach and heartburn, and by the condition of the urine, which contains a sediment of lithate of ammonia or lithic acid gravel, or which, without this, is high-coloured and more than commonly acid. With this acid indigestion there is often insufficient action of the liver, a bilious tinge in the complexion, costive bowels, a coated tongue, which sometimes dries at night, and heavy or disturbed and unrefreshing sleep.

In this form of indigestion, much relief is given by alkalies, which neutralize the excess of acid in the stomach when digestion is over, and thus stop or prevent the uneasy sensations to which it gives rise. The soluble alkalies do good also, and more permanent good, by promoting the secretion of the liver and the kidneys. The bicarbonate of soda and the bicarbonate of potash are, in most instances, the best forms in which these can be given, and the best time for giving them, as was pointed out by Dr. Prout, is two or three hours after the principal meals. Fifteen grains of either, two or three times a day, is, in most cases, a sufficient dose; and, if there be a sense of heat in the stomach, this may be conjoined, as Prout recommended, with a few grains of nitre.

At the same time, a few doses of blue pill may be given on alternate nights, further to promote the secretion of the liver, and colocynth, or colocynth with henbane, to keep up free action of the bowels.

The use of the alkalies should be continued for some weeks, and, if any gouty symptoms exist, a grain of acetous extract of colchicum may be given at night.

Persons who suffer from this kind of indigestion should endeavour to promote the action of the lungs and the skin, and, with this object, should take active exercise, be much in open air, and sleep in an airy bed-room; and they should live on a simple and abstemious

diet—not eating too largely of animal food, and carefully avoiding ill-fermented malt liquors, rich dishes, heavy pastry, and cheese. Where total abstinence is not feasible, the alcoholic drinks best suited to them are pale sherry, in small quantity, or brandy, largely diluted with water.

By such means the indigestion may often be stopped, the excessive acidity of the urine corrected, and the general health greatly improved; but the disorders have their origin in a peculiarity which is constitutional and abiding, and they are, therefore, very liable to recur.

Another faulty state of the general health attended with indigestion is now and then met with, in which the urine is apt to contain oxalic acid in considerable quantity, and to precipitate, on standing, the well known octohedral crystals of oxalate of lime.

Dr. Prout supposed that a more than common disposition to the formation of oxalic acid in the system is indicative of a peculiarity of constitution; and he expressed this supposed peculiarity by the term *oxalic diathesis.*

Oxalic acid, which is composed of only carbon and oxygen, with the elements of water, and which exists in many plants and may be readily formed by the oxidation of various animal and vegetable substances, may come to be present in the urine in several ways

1st. It may be taken in the food; may escape conversion in the stomach, and after its absorption into the blood; and may thus pass off in the urine, in combination with lime.

Many vegetables contain oxalic acid in combination with alkalies or with lime. The stalks of rhubarb, which in the spring are largely eaten in this country in tarts, and sorrel, which is much used abroad as salad, contain it in considerable quantity in combination with alkalies. In some persons, the oxalic acid taken in these articles of food is changed in the process of digestion, or undergoes conversion in the blood by the influence of oxygen, and, consequently, does not pass off, as oxalic acid, in the urine. In others, whose power of digestion is weaker or in whom respiration is less active, the oxalic acid escapes conversion and passes off in the urine in combination with lime.

This may happen in persons who are in perfect health and who have no marked tendency to the formation of oxalic acid in the system. With this occasional, and, if we may so term it, *accidental* presence of oxalic acid in the urine, we have nothing here to do. It

may lead to the formation of a small calculus of oxalate of lime, and so have very serious results; but it does not denote any abiding disorder of digestion or nutrition.

2nd. Oxalic acid may be formed in the body, and, as Dr. Garrod has shown, its presence may be detected in the blood when none of it is taken in the food.

The oxalic acid which is formed in the body may, possibly, be derived immediately from the saccharine elements of the food, or from lithic acid and other substances that result from the waste of the tissues, or from both these sources at once.

We know, indeed, that, out of the body, oxalic acid may be readily formed, under the influence of oxidizing agents, from sugar, starch, and their chemical equivalents; and Liebig and Wohler have shown that it may also be readily formed from lithic acid.

Dr. Prout long ago inferred that oxalic acid might be derived from the waste of the tissues, from the fact that its habitual or frequent presence in considerable quantity in the urine is often associated with an unhealthy condition of the skin, and also from the fact, that, in rheumatic and in hectic fever, large quantities of another non-nitrogenous acid—lactic acid—which must, he imagined, have their source in waste of the tissues, are formed or set free in the body.

Oxalic acid is said to be constantly present in the urine of herbivorous animals; and, according to Lehmann, it often exists in the urine of men in perfect health, but in such minute quantity that it is not readily discovered. It may then, he says, be sometimes made apparent by freezing the urine. When urine is frozen, a great part of the water crystallizes in a comparatively pure state, and if this be removed, the concentrated urine that remains deposits crystals of oxalate of lime.

The quantity of oxalic acid is found to be increased, so that the urine, without any such concentration, deposits numerous crystals of oxalate of lime, under many circumstances:—

1. It is increased, according to Lehmann, by emphysema of the lungs, by the diminished elasticity of the lungs that results from repeated attacks of catarrh, and by other conditions that impede respiration, and thus prevent perfect oxidation of the carbon, which passes off in the urine as oxalic acid, instead of escaping in the form of carbonic acid by the lungs.

It is also increased, according to him, by drinks that contain much carbonic acid, and by the alkaline bicarbonates and vegetable salts; and he accounts for this increase by supposing that the super-

fluous carbonic acid which has entered the blood or been generated there from the salts of the vegetable acids, must obstruct the absorption of oxygen and impede the perfect oxidation of those substances in the blood which support respiration.

2. The quantity of oxalic acid in the urine is often increased, as Dr. Walshe has shown, during convalescence from typhus fever, rheumatic fever, and other acute diseases, in states of anæmia, and in the course of many chronic diseases that interfere with nutrition.

3. A considerable deposit of oxalate of lime often exists in the urine of persons who have no appreciable disease of the lung or other organs, and who have had no positive illness, but who have disordered digestion and look and feel out of condition. As the general health improves, the oxalate of lime disappears from the urine; but under the influence of fatigue and many other conditions unfavourable to health, the indigestion and other ailments recur and the oxalate of lime appears again.

Dr. Prout, observing an especial tendency to this kind of disorder in certain persons and certain families, and believing that diabetes, which he considered on chemical grounds to be a kindred malady, was constitutional, and to a certain extent hereditary, was led to suppose that the especial tendency to the formation of oxalic acid and the concomitant disorder of health had its origin in a peculiarity of constitution, and, as I have already mentioned, he designated this supposed peculiar constitution the oxalic diathesis. There is, however, no constant connexion between the disordered state of health and the presence of oxalate of lime in the urine. A copious deposit of oxalate of lime may result from other conditions, and the ailments we are considering may exist without the oxalate. Very often, however, the ailments and the oxalate coexist, and constitute and define a disorder which it is very important to recognise, because experience has shown that it can generally be controlled or much mitigated by a particular plan of treatment.

To the patient nothing seems amiss in the urine. He complains only of his indigestion and its accompanying ailments. It is the form of this indigestion that we have now to consider.

It presents no striking or distinctive characters. The appetite is often good, sometimes more craving than in health; digestion is not slower than it should be; there is no pain, no sense of oppression or weight at the stomach immediately after meals; there is seldom vomiting or heartburn. But much discomfort is caused by flatulent distention of the stomach, especially two or three hours

after a meal, when the stomach is getting empty, and sometimes there is pain in the stomach at that time. With this flatulent distention of the stomach there are often uneasy sensations in the belly that seem to result from flatulent distention of the duodenum or colon.

This disorder of digestion is usually associated with other symptoms of unconstitutional disorder, and especially with nervous symptoms. The patient in most cases grows somewhat thinner, is weak and readily fatigued, sleeps badly, is troubled with palpitation, is irritable in temper, and depressed in spirits, and often hypochondriacal in a high degree, and has, or fancies he has, deficiency of sexual power. Frequently, too, he has a wearing pain, or a sense of uneasiness, across the loins, and empties his bladder more frequently than in health,—symptoms resulting probably from irritation of the urinary organs by the passage of the oxalic acid through them.

In some cases there is evidence of defective or faulty nutrition of the skin in a scaly eruption or a succession of boils.

These ailments vary greatly in degree in different cases. In some, they are very trifling; in others, the restlessness at night and the mental depression unfit the patient for his usual occupations and render his life miserable. They are none of them peculiar to the disorder we are considering. Taken together, indeed, they often form a group that is tolerably significant; but the only sure evidence that oxalic acid is in excess is the presence of numerous crystals of oxalate of lime in the urine.

The urine is then always acid, generally more acid than in health; in most cases of an amber colour and transparent, and of moderate or rather high specific gravity. If allowed to stand in a conical glass vessel, a light cloud of mucus may form at the bottom, but there is often no other deposit.

In some cases, however, together with oxalate of lime, the urine contains an excess of urea, and is of higher specific gravity than in health; or it contains an excess of lithic acid, or of lithate of ammonia, and these substances are deposited at the bottom of the glass.

The crystals of oxalate of lime are not visible to the naked eye, except when many of them are entangled in a dense cloud of mucus at the bottom of the glass, in which case they can sometimes be seen as minute glistening points; but they may, as Dr. Golding Bird first showed us, be in all cases readily discovered by help of the

microscope. The detection of them is important, because it throws light on the nature of the disorder and may determine the plan of treatment.

A disposition to such recurring derangements of the general health and to the formation of oxalic acid in the system, may—like the disposition to gout, diabetes, and other kinds of faulty assimilation—either be inherited, or be induced, where no inherited tendency to it exists, by certain external conditions or habits of life.

The conditions which Dr. Prout assigned as most conducive to it, are—residence in a damp or malarious district, the too abundant consumption of sugar, the depressing emotions of anxiety and grief, exhausting bodily or mental labour, long courses of mercury, excessive smoking, and, indeed, all other circumstances that seriously depress the vital powers.

Among the inhabitants of this great city, there are, I believe, no circumstances that conduce to it so much as the foulness of the air we are always breathing, and the anxiety and exhausting labour of mind and body that are almost inseparable from the pursuit of wealth or distinction.

Now, all these conditions, by their action on the nervous system, enfeeble respiration; and it seems probable that, as Lehmann has suggested, the formation of oxalic acid may be immediately owing to the defective oxidation of those materials in the blood by which respiration is supported: but, in the cases we are considering, it is not the less dependent on derangement of the general health, which is apt to recur, and which constitutes a definite object of medical treatment. In some cases it seems, from the high specific gravity of the urine and from the large quantity of urea that co-exists with the oxalate of lime, that there is a more rapid waste of the tissues than is natural, and that the respiration is not absolutely, but only relatively defective,—insufficient, that is, for the complete oxidation of the large quantity of combustible materials on which the inspired oxygen acts.

The indigestion and the various other ailments that result from this general derangement of health are much under control.

The remedy of most efficacy, where the urine is free from a red deposit, is the nitro-muriatic acid, which often prevents the formation of oxalic acid after a few days, lessens the flatulence and the palpitation, and makes the sleep quiet and the spirits more cheerful. From eight to twenty minims of each of the dilute acids may be

given twice a-day in a glass of water, half an hour before breakfast and half an hour before dinner.

It was long ago known that nitric acid, or the nitric and muriatic acids, have occasionally great efficacy in indigestion; but it was Dr. Prout who rendered our knowledge on this point precise, and showed that it is in the particular form of indigestion we are considering, and in persons in whom there is a disposition to the formation of oxalate of lime in the urine, that they are especially of service.

The mineral acids have a tendency to cause a deposit of lithic acid, or of lithate of ammonia, in the urine, and when such a deposit exists, it is seldom advisable to give them longer. Dr. Prout tells us, that when his patient lived at a distance in the country, he commonly advised him to take the acids for a month or until lithic acid or lithate of ammonia appeared in the urine.

All ailments that result from faulty assimilation and that depend primarily on peculiarity of frame or constitution are very liable to recur. If, therefore, the mineral acids should prove of service, they may be had recourse to again and again, on each recurrence of the same disorder.

If the tongue be clean, some of the light bitter tonics may be given with advantage in conjunction with the mineral acids.

When the urine from the first has a deposit of lithic acid or of lithate of ammonia, the mineral acids should not be given, and the best substitute for them that I know of is the carbonate or the aromatic spirit of ammonia.

Where there is want of sleep, and great nervous irritability, and much flatulence and palpitation, the tincture of henbane, or the dilute hydrocyanic acid, or some other sedative, may be given with advantage in conjunction with either of the medicines I have just mentioned.

So much for remedies which the Pharmacopœia supplies.

The proper regulation of the diet is equally important. Dr. Prout, considering the excessive use of sugar as one of the causes of this disorder of health, laid it down as a rule, that saccharine articles of food and particularly *sugar*, should, as much as possible, be avoided; and that the diet should consist chiefly of animal food and the stronger farinaceous matters.

He advised, also, that the patient should abstain as much as possible from alcoholic drinks, and that, when he cannot abstain entirely, he should select in preference to others, sherry, or brandy properly diluted with water. In some cases, however, these are too

heating, and sound malt liquor, or hock, or claret, may be substituted for them.

Many years have elapsed since these injunctions were made, and the wisdom of them, as general rules, has been fully established.

It is very important, also, that the patient should change for a time his habits of life. If he is an inhabitant of a large city, and exhausts himself with mental or bodily labour, country air, rest, and recreation, are often sufficient of themselves to restore the health.

Long-continued and severe functional disorder of the stomach—so long-continued and severe as even to destroy life—now and then occurs without our being able to discover the original cause of disturbance. An instance of this has lately fallen under our notice in King's College Hospital in a man named Peter Brisbane, who was admitted into the hospital on the 25th of April, 1855, with what was supposed to be fatal organic disease of the stomach in its last stage, and died there on the 7th of May. He was a Scotchman, 42 years of age, of moderate height and well formed, and had been employed as a baker in London for twenty years. He stated that his habits had always been temperate, and that his health was good until two years and a half before, when he began to be troubled with pain at the epigastrium and vomiting. The pain came on after food, and he was free from it as long as the stomach was empty. It was more severe after solid than after liquid food, and he was soon unable to take the heavier kinds of meat, as beef and veal, at all. The articles of food that seemed to agree best with him were rice, custard, and other light puddings. As a rule, the pain did not come on until an hour after meals, and after lasting somewhere about an hour, it ended in vomiting. He was also at this time troubled with heartburn and waterbrash, and occasionally, even when the stomach was empty, would vomit small quantities of bile. He did not lose the desire for food, but ate little at a time for fear of bringing on the pain. He could not point to any particular spot as having been the seat of this pain, but referred it to the whole surface of the stomach. From the beginning of his illness he became languid and out of spirits, and lost flesh; but the loss of flesh did not proceed beyond a certain point.

The condition just described continued with little variation for eight or nine months, when the stomach-disorder abated and he gained flesh. He did not, however, recover completely. Every four or five days pain in the stomach recurred, and he did not re-

gain his spirits or lose entirely the feeling of languor. Six or eight months before his admission to the hospital, the disorder returned in an aggravated degree—the pain coming on almost immediately after eating, being very severe, and ending soon (generally, in half an hour) in a fit of vomiting. He now also had eructations of a very disagreeable taste, not, however, particularly resembling that of rotten eggs.

These symptoms continued, he began again to lose flesh, and this more rapidly than before, and soon became very pallid.

On his admission to the hospital he was extremely pallid, had an anxious look, and was thin, but not wasted in a great degree. On auscultation at the base of the heart and root of the neck, those murmurs were heard which extreme anæmia causes. All his ailments were referred to the stomach. He complained of a diffused pain in the stomach after meals, frequently vomited soon after eating, and now and then vomited some bile when the stomach was empty. He was troubled also with heartburn and often with eructations which he described as being sometimes nauseous and once as tasting sweet. He had no desire for food—eating, as he said, only because he felt exhausted: and his nights were restless. The tongue was clean, but very pale; the skin generally hotter than natural; the pulse rapid—the numbers counted after his admission to the hospital ranging from 105 to 124. The urine was tested for albumen and found to be free from it, and there was no discoverable disease in any other part of the body. He was ordered a farinaceous and milk diet, with eggs, and small doses of steel. On the 30th of April, five days after he entered the hospital, diarrhœa set in, and he died of sheer debility and bloodlessness on the 7th of May.

Who would not have supposed after this that the stomach would have been found much diseased? On examination, however, it was found to be of its natural size and shape, and its lining membrane was quite sound, and had undergone no apparent change of texture. There was a suspicion of some thickening about the pyloric ring, but the reality of this, as a morbid change, was extremely doubtful. No disease was discovered in the liver, spleen, lungs, bowels, or kidneys. The kidneys, on the suspicion that there might be some degeneration of their gland-structure, were examined under the microscope and found to be sound. The terrible gastric disorder was evidently functional, for there was no change in the sto-

mach to account for it, but the cause of the disorder, even when every part of the body was laid open to examination, eluded our search. The extreme pallidness leads to the inference that the cause of disturbance was in the blood-making organs.

LECTURE XIII.

Forms of indigestion characterized by some peculiarity in the symptoms—Urticaria—Pyrosis.

We have lately considered some forms of indigestion connected with derangement of the general health, and characterized by an unusual tendency to the formation of certain principles in the system; which principles pass off, and may be detected, in the urine. I come now to speak of other forms of indigestion, which probably lead to the formation of unnatural matters in the system; but these matters have not been distinguished, and the disorder is defined by some peculiarity in the symptoms.

The disorder of this class that I shall speak of first, is one characterized by an eruption of nettle-rash.

Nettle-rash may be produced in various ways. It may be produced by the direct application of a sting-nettle or some other irritating substance to the skin itself; and it occasionally occurs without this—probably from some irritating matter formed in the system and conveyed to the skin with the blood,—in ague, in jaundice, in rheumatic fever, and in disordered states of the menstrual function. Its most frequent cause, however, is indigestion, or, rather, imperfect digestion of particular articles of food.

When brought on in this way, it occasionally occurs in persons whose digestion is not generally weak, from eating some particularly unwholesome or indigestible substance. The substances that have been observed to bring it on most frequently are, shell-fish, especially crabs and mussels, other fish of various kinds when tainted or out of season, honey, various vegetable substances, especially mushrooms, cucumbers, almonds, oatmeal. I have lately met with an extensive nettle-rash which was ascribed to a pork-pie, and once suffered from it myself, in common with two other persons, from eating mackerel.

In such cases, the eruption generally comes on within an hour or

two after the unwholesome substance has been eaten; and, when it is extensive, is generally attended with nausea and uneasiness at the stomach, a sense of constriction at the chest, restlessness, confusion of the head, and heat, swelling, and flushing, first of the face, and soon afterwards of the entire surface. These symptoms are sometimes soon followed by pain or uneasiness of the bowels and diarrhœa.

The object of treatment should, of course, be to expel, as soon as possible, the offending matter from the intestinal canal. The stomach may be first emptied by an emetic of ipecacuanha or sulphate of zinc, and the bowels afterwards cleared by some warm but quickly acting purge.

When the offending matter is thus got rid of, the eruption in most cases soon disappears, and some degree of debility is the only effect of the disorder that remains.

Nettle-rash may, as I have said, be brought on by eating some substance particularly unwholesome, in persons who have no permanent weakness of digestion. The fault is not so much in the stomach as in the food; but the disorder is much more apt to occur, even in this way, in persons whose digestion is habitually weak.

Some persons, on the contrary, have frequently recurring nettle-rash from eating substances which others readily digest. With them it is the stomach that is chiefly at fault, and its weakness is shown by general slowness of digestion and by inability to digest particular articles of food. The eruption in such cases is seldom extensive, but recurs very frequently, generally an hour or two after dinner—which is the heaviest and most complex meal of the day—or in the evening. It harasses the patient for two or three hours, or during the greater part of the night, and then disappears until the imperfect digestion of another meal brings it on again. In some persons it is caused by common articles of food, and recurs almost daily for years together: in others, it is caused only by some particular substance.

One of my former pupils at the College was affected in this way only from eating oatmeal. In a letter which I received from him in 1842, he says,—"The peculiarity of my constitution in reference to the action of oatmeal upon it first manifested itself about four years ago. Prior to this time the singular susceptibility did not exist, I believe, for I can recollect that in my boyhood I could take oatmeal gruel as well as most persons. But about four years ago, having a cold, I took, according to custom, a cupful of gruel on going to bed.

"I had taken nothing before or with it, and with the exception of a common slight cold, was perfectly well. I lay down, but felt no inclination to sleep. I soon became very restless, and my skin hot and irritable; a violent sneezing came on; my eyes felt hot and painful; they soon discharged. The sneezing became unceasing, accompanied also with discharge; I was very feverish and thirsty; my head was swollen, hot, and painful. This extended to my whole body; it became swollen, and covered with wheals accompanied with intolerable itching. The combination of all the symptoms produced in me the most wretched state of mind, amounting to perfect misery. I tried walking about in the cool air, but without any relief. A medical friend with whom I was residing gave me a saline effervescing draught, with a few drops of the wine of colchicum. Whether by the aid of this or that the irritation had worn itself out I know not, but as nearly as I can recollect, in about two hours from the accession of the horrors, they began to abate. I again went to bed, this time exhausted, fell asleep, and found myself the next day not much the worse for the illness: a slight feeling of debility was the only sensible effect of it.

"Some time after this I suffered in the same way, but less severely, from eating soup that contained some oatmeal.

"A more remarkable instance occurred in the summer of 1839. I was in the country, and having occasion to go into the stable just before taking a walk, I put two or three oats into my mouth. I had not walked above a mile before I began to sneeze, and the symptoms above described quickly came on, but much milder. I soon recognised my old enemy, and recollected eating the oats. I was glad to get home as quickly as possible. The irritation soon left me this time, and I have not since repeated the experiment."

An account very like the one I have read to you is given by Willan in his work on "Cutaneous Diseases," in the words of Dr. Winterbottom, who twice had an extensive nettle-rash from eating a few sweet almonds; and another similar account drawn up by Dr. Gregory, who once had an illness of this kind from eating almonds, and once from eating an unpeeled green cucumber.

When brought on in this way, the duration of the disorder is very various. Dr. Winterbottom states, that in his first attack the illness came on within a few hours after eating the almonds, and continued during the greater part of the night. It gradually abated towards morning, and the next day not the least vestige of the com-

plaint remained. In his second attack, the illness came on a few hours later, and lasted the greater part of the ensuing day.

Dr. Gregory states, that in him the disorder brought on by the sweet almonds went off the next day; that brought on by the cucumber continued four days, and was at length removed by a cathartic.

I have known a nettle-rash that seemed to be accidentally brought on by eating tainted fish, last for months.

Willan tells us that he has known an extensive nettle-rash proving very troublesome for a length of time, induced, in persons otherwise healthy, by rubbing oatmeal on the hands and wrists.

It would seem from this, that, with respect to oatmeal, the irritating matter that causes the eruption is not developed in the stomach, but exists, ready formed, in the oats, and merely escapes transformation in the process of digestion.

It is well known that the principles to which many substances owe their smell and flavour are not changed by the gastric juice. The odoriferous principle of asparagus passes off in the urine without any diminution of its aroma; oysters and many other substances are often tasted again, with a heightened flavour, hours after they were eaten, and when they are perfectly dissolved in the juices of the stomach.

When nettle-rash is brought on by eating some substance in common use, and recurs frequently, the offending substance may sometimes be detected by the plan followed by Willan. He says,—"I have desired several persons affected with chronic urticaria, to omit first one and then another accustomed article of food or drink, and have thus been frequently able to trace the cause of the symptoms. This appeared to be very different in different persons. In some, it was malt liquor; in others spirit, or spirit and water; in some white wine, in others vinegar; in some fruit, in others sugar; in some fish, in others unprepared vegetables. I must, however, confess that several cases have occurred to me where a total alteration of diet did not produce the least alleviation of the complaint."

It sometimes happens that a nettle-rash resulting from defective digestion is brought on not merely by some one substance, but by several substances in common use; and it is then very difficult to detect the offending substances, or to prevent the disorder by any restriction of diet to which the patient will submit.

In such cases, the disorder may sometimes be prevented by giving daily, immediately before dinner, or before breakfast and before

dinner, a pill containing three or four grains of rhubarb; or, what is still more effectual, three or four grains of rhubarb and from half a grain to a grain and a half of the powder of ipecacuanha.

I several years ago learnt the occasional efficacy of rhubarb given at such times from a lady, who told me that she was harassed by frequently recurring nettle-rash for many years, and consulted many physicians and tried various remedies in vain, until some person who had suffered in the same way advised her to eat a few grains of rhubarb every day, just before breakfast and just before dinner. She followed the advice, and was freed from the nettle-rash. After some time she left off the rhubarb, and the nettle-rash returned. She took the rhubarb again, and the nettle-rash again disappeared. This experiment she often repeated at distant intervals, and always with the same result. When she gave me this account she had continued the practice of thus eating rhubarb for several years, with the occasional intermission of a few days, by way of experiment. She had a persuasion that if she then left off the rhubarb the nettle-rash would recur.

Small doses of rhubarb and ipecacuanha are, as I have before observed, often of service where, from slowness of digestion, a sense of weight and oppression at the stomach is felt for some hours after meals, and seem to quicken and strengthen digestion by increasing the flow of the gastric juice.

While taking these medicines the patient should endeavour to strengthen digestion by exercise and fresh air; should be careful not to eat too much at a time, or too often; and should live on a very simple diet—avoiding spirits, and cheese, and pastry, and uncooked vegetables, and, in particular, those substances which have an especial tendency to bring on nettle-rash.

It sometimes happens, especially in women, that the nettle-rash, though depending immediately on the stomach, occurs only when digestion is weakened by over-fatigue, or by anxiety or some other mental emotion, or by profuse monthly discharges, and that remedies of a different class are availing.

In some such cases, where all the means I have before spoken of had failed, I have known the eruption disappear under the use of carbonate of ammonia, alone or in conjunction with tincture of gentian.

Serpentaria is another remedy that has obtained some repute in the treatment of this disorder, but I have never made trial of it.

I may as well observe here, that the irritation of nettle-rash, what-

ever be its cause, may be much allayed by a lotion made by mixing half a drachm of acetate of lead and half an ounce of tincture of opium with eight ounces of water.

Another variety of stomach-disorder, well-defined by its symptoms, is *pyrosis* or *water-brash.*

What serves to distinguish water-brash are fits of heartburn—that is, of a burning sensation at the pit of the stomach, or extending from the stomach to the fauces—followed by the rejection of a liquid, thin and colourless like water, which seems to be forced into the mouth by a kind of ruminating action of the stomach and œsophagus.

The term pyrosis expresses merely the sensation of burning; the popular terms, "water-brash," and "water-pang," are meant to express the combination of the two symptoms that distinguish the disorder—the sensation of burning, and the rejection of the liquid.

Water-brash sometimes results from a palpable source of irritation in the stomach itself, or in some organ that can much affect the stomach by sympathy.

It now and then occurs in organic diseases of the stomach, especially cancer and simple ulcer.

It occasionally results from pregnancy, in which case the disorder often continues till the womb delivers its burden.

Dr. Watson has spoken of a case in which it seemed to be owing to an enormous liver which pressed upon the stomach.

But it often occurs when there is no serious disease of the stomach, nor any palpable cause of disturbance elsewhere, and constitutes the most characteristic symptom of a gastric disorder which has always been very common among the poor in the northern countries of Europe, where its prevalence seems to have been mainly attributable to unwholesome diet.

It is stated, on the authority of Linnæus, that it was very prevalent in Lapland when the great botanist travelled there in 1732.

Cullen tells us that it was a frequent disorder among the poor of Scotland in his time, and that it also occurred there, though more rarely, in people of better condition.

Dr. West, writing in 1841, states that it was then endemic among the poor in North Wales.

A few years ago it was common in the North of England, and also, as I can myself testify, in some parts of the West of England, among the peasantry, who then subsisted almost entirely on coarse farinaceous and other vegetable food.

It is less frequent in towns than in rural districts, but still is not uncommon among the dispensary patients in London, especially the women, who have bad and insufficient food, and at the same time live much in doors and are subject to many other depressing influences.

A good description of this endemic water-brash has been left us by Cullen, who saw much of it in Scotland. He says:—

"The fits of this disease usually come on in the morning and forenoon, when the stomach is empty. The first symptom of it is a pain at the pit of the stomach, with a sense of constriction, as if the stomach was drawn towards the back. The pain is increased by raising the body into an erect posture, and therefore the body is bended forwards. This pain is often very severe; and, after continuing for some time, it brings on an eructation of a thin, watery fluid in considerable quantity. This fluid has sometimes an acid taste, but is very often absolutely insipid. The eructation is for some time frequently repeated, and does not immediately give relief to the pain which preceded it, but does so at length, and puts an end to the fit."

In the next paragraph Cullen says: "It is often without any symptoms of dyspepsia." This statement, however, is not perfectly correct. The water-pang is often the only ailment complained of, and the disorder is popularly known by this name; but generally flatulence and other evils of feeble digestion co-exist with it.

The disorder varies very much in duration and degree. In some cases it occurs only occasionally and for a short time; in others, it continues, with occasional intermissions, for months or years. In some, only an ounce or two of fluid is ejected in the day, and this seems to be secreted in the mouth only; in others, for months together, as much as a pint or more is ejected daily, by distinct efforts of rumination, which sometimes pass into vomiting.

The disorder most frequently occurs in states of anæmia, and by impairing digestion and causing a drain from the system, tends to produce further debility, so that when it is severe, and has lasted long, the patient is usually pale, and thin, and weak, and out of spirits.

The fluid is, as I have said, thin and colourless, looking very like saliva. It is generally slightly alkaline and almost tasteless, but sometimes, even in persons in whom it is commonly insipid, it is sour. When alkaline or insipid, it has the characters of saliva: when sour, it contains some of the gastric acids. The character

of the fluid depends very much on the time of its ejection. The fluid ejected soon after a meal is commonly alkaline, and probably consists chiefly of saliva, the alkalinity of which increases during the process of digestion; the fluid ejected towards the completion of digestion is frequently sour.

It has often been a question—What is the source of the fluid in pyrosis? Does it come from the stomach, or from the pharynx and mouth, or from both these sources at once?

Some persons have, indeed, supposed, from the resemblance which the fluid has to saliva, and from the effort of vomiting or rumination that attends its rejection, that it might come from the duodenum or the pancreas. But such a supposition is scarcely admissible. As Dr. West, who has published an admirable treatise on pyrosis, has well observed, fluid could hardly be forced up from the duodenum into the mouth without more violent efforts than attend the rejection of the fluid in pyrosis; and if the fluid secreted by the pancreas were so forced up by an inverted action of the bowel, the fluid secreted by the liver, which is poured into the intestine at the same spot, must be forced up as well. But the fluid of pyrosis, though often sour from containing some of the gastric acids, is never bitter and never tinged with bile.

The fluid must, then, come either from the stomach or from the œsophagus and mouth, or from both these sources at once.

There can be little doubt that, when the fluid is acid, it consists, at least in part, of acids secreted or formed in the stomach; but there is reason to believe, that when it is alkaline it is derived chiefly, if not exclusively, from the salivary and other glands in the mouth and pharynx, and that it is secreted under the influence of an uneasy sensation in the stomach, which is especially felt when the stomach is empty of food.

In a former lecture I remarked, that irritation of the fauces may excite the secretion of gastric juice, and that Spallanzani, by tickling his own fauces in the morning before breakfast, when the stomach was doubtless empty, obtained gastric juice enough to perform some experiments on digestion, of which he has given an account. There can be little doubt that certain kinds of irritation of the stomach may excite the action of the secreting follicles in the fauces.

M. Velpeau, at one of the meetings of the Académie de Médicine in 1849, related the case of an agricultural labourer, thirty-two years of age, who had swallowed a large iron fork, with which he

had attempted to extract or force downwards a veal bone which had stuck in his throat. The attempt bringing on vomiting, he let go the fork, which, after some movements of deglutition, fell into the stomach. The account states, that at first he did not suffer much pain, but that after a while his sufferings became almost intolerable, especially after he had taken food or a little drink. From time to time he had the desire to vomit. *Water often came in abundance in his mouth.* The fork lay at first in the big end of the stomach, with its prongs turned towards the left side. It remained in this position a fortnight, and then approached the pylorus, where it remained nearly four months. During all this time vomiting of black matters occurred several times a day; *the mouth was continually filled with a watery liquid;* his sufferings were excessive and unceasing; and he could not support the least nourishment. The fork then passed through the pylorus, and, twenty months after he had swallowed it, was discharged by the bowel.

All authorities on the endemic water-brash agree with Cullen, that it is much more frequent in women than in men, and much more frequent in grown-up persons than in children.

It does not prevail equally at all seasons, but is much less frequent in summer than in winter and spring.

In Scotland, it has long been generally ascribed to the diet of the poor consisting too exclusively of farinaceous food. The supposition that the disorder is so produced explains its prevalence among the poor in the rural districts in Scotland, in North Wales, and in the north and west of England, where oatmeal or barley-bread is—or rather was until lately—for some months in the year one of the chief articles of subsistence with the poor. It explains the general exemption of the rich, who have a more nutritious and a more varied diet. It explains the fact, that, even among the poor, the disorder has been much more frequent in rural districts than in London and other large cities, where the poor have eaten wheaten bread and consumed larger quantities of animal food.

The circumstance that the disorder has prevailed chiefly in the northern countries of Europe, where spirits are plentifully drunk, has led to the belief expressed by most writers on the subject, that spirit-drinking has had great influence in bringing it on. There can be little doubt that the intemperate use of spirits, by causing a catarrhal condition of the stomach and uneasy sensations in the stomach when it is empty, occasionally produces water-brash; but the supposition that the water-brash that has been endemic in the

northern countries is attributable to this condition is hardly reconcilable with the fact, that the disorder has always been very much more common in women than in men, while men have been doubtless the chief consumers of spirits.

The circumstance that the disorder has prevailed chiefly in the northern countries of Europe, and that it has been there less frequent in summer than in winter and spring, has also led to the supposition that cold and wet have great influence in bringing it on. The supposition is most probably true. The combined influence of cold and wet, by deranging the chemistry of the body and by checking the action of the skin, is often instrumental in rendering the secretions of the stomach unhealthy; and when a catarrhal or a very acid state of the stomach exists, it is very important, with the view of removing it, to keep up the action of the skin. But the greater prevalence of the disorder in the northern countries and in cold seasons is probably attributable in much greater degree to the influence of diet. In warmer countries, the poor inhabitants live, indeed, on vegetable food, but not so exclusively on coarse farinaceous food as the agricultural poor in the north of Europe. The fact that in Scotland, and in the north of Europe generally, the disorder gets less frequent as summer advances, may be in great measure owing to the circumstance, that milk is then more abundant and more largely consumed by the poor. It has been shown of late, that milk has great efficacy in preventing and curing scurvy. Milk, the sole food of the young of mammalia, contains all that is requisite for the growth and nutrition of the body, and will doubtless remedy many disorders engendered by a diet wanting in some of the elements required for healthy nutrition.

It would seem, then, most probable that the disorder, in countries in which it is endemic, is mainly owing to the influence of climate and to the diet of the poor not being sufficiently varied, and consisting too much of coarse and innutritious farinaceous food.

But if such be the main causes of the disorder, there are, doubtless, various other conditions that assist in bringing it on. Most of these may be classed under two heads:—

1. Excessive labour, insufficient clothing, loss of blood, and all other conditions that tend to exhaust the body.

2. Pregnancy, constipation, anxiety, and other conditions that tend to disorder the functions of the stomach.

We have already seen that water-brash occasionally occurs in a high degree in the wealthy classes, especially in women, where it

cannot be ascribed to any peculiarity in diet, and seems to be owing solely to such conditions as these.

Pyrosis, then, considered with reference to its remote causes, is of two kinds:—

1. That which has been termed by some writers *symptomatic* pyrosis, which is brought on (without any peculiarity in diet) by pregnancy, or some other condition that disturbs the functions of the stomach.

2. That which has been termed, in contradistinction to the former, *idiopathic* pyrosis, which prevails chiefly among the agricultural poor in rural districts, and which seems, in most cases, to be mainly owing to defective diet.

In either case the disorder appears to be immediately dependent on a catarrhal condition of the stomach, or on some other condition that renders the secretions of the stomach unhealthy and irritating.

Many conditions conspire to render it much more frequent in women than in men. Women are much more frequently in states of debility, from the nature of their constitutions and from their having in suckling and in excessive or unnatural uterine discharges, causes of exhaustion from which men are exempt; they have also more excitable nervous systems, and, in consequence, the functions of the stomach in them are more apt to be deranged by mental influences and by disease in other parts of the body; and, among the lower classes, they have generally a less nutritious diet.

In the treatment of water-brash, our first endeavour should, of course, be to remove the conditions that may seem to have brought it on or to maintain it.

If the disorder should seem to have been mainly caused by a diet not sufficiently nutritious, or consisting too much of farinaceous substances, the remedy most likely to be effectual will be a wholesome nourishing diet, containing a proper quantity of animal food *in its most digestible form*. Little permanent benefit can, indeed, be expected from medicine unless the diet is improved.

If the disorder should seem to have been induced, or to be kept up, wholly or in part, by fatigue, it is very essential that the patient should rest; if by constipation, that this condition should be removed by purgatives, such as aloes or colocynth, that do not offend the stomach.

After these points have been attended to, much further good may be done by medicines.

The medicines that have been found most useful in pyrosis are—

1st. Medicines which have an astringent action on the coats of the stomach. Among these may be classed bismuth, lime-water, and the vegetable astringents—kino, catechu, krameria, logwood.

2nd. Sedatives, especially opium and the salts of morphia, which probably also tend to restrain undue secretion by the mucous membrane, but which are chiefly of use in allaying the gastralgia that attends pyrosis.

Medicines from these two classes may often be combined with advantage. Five grains of bismuth with a twelfth of a grain of the muriate of morphia, or five grains of the compound kino powder, or an efficient dose of catechu, krameria, or logwood, with opium, may be given before meals two or three times a day.

3rd. Some other medicines have obtained repute in pyrosis which cannot be classed with the preceding. They have most of them an astringent action on the coats of the stomach, but act, directly or indirectly, on the nervous system as well. The chief of these are, nitrate of silver, which may be given in pills, in doses of half a grain, three times a day; nux vomica, which may also be given in pill, in the dose of from three to five grains, three times a day; quinine; and the mineral acids.

Some of the medicines I have mentioned have been popular remedies for pyrosis in districts in which the malady has prevailed.

It is stated that nux vomica is a popular remedy among the Laplanders, to whom it was recommended by Linnæus, and that lime-water was some years ago a popular remedy among the rural population of North Wales.

4th. The disorder is often connected with anæmia, and steel is of great service both in removing it and in preventing its recurrence.

The medicines of which I have had most experience in disorders of this class, and which are probably as efficacious as any, are bismuth, with morphia; krameria and logwood, with opium; and steel.

There is another kind of gastric disorder which is closely allied to water-brash, and which is characterized by paroxysms of violent pain at the stomach, often described as spasm, that come on when the stomach is empty. While the pain lasts the epigastrium is tender to the touch, and the pulse gets slow and the surface of the body cold. The pain is generally relieved by taking food, no matter what, and by lying down.

The disorder is often unattended with vomiting or nausea, but now and then, when the pain is very severe, vomiting occurs, especially

on any movement of the body. There may be few other symptoms of dyspepsia. The appetite, in the intervals of the pain, is not unfrequently good, and digestion is tolerably quick and without uneasiness, unless the disorder is very severe, when but little can be eaten or digested. The tongue is usually pale and flabby, but clean. In most cases the patient is weak and sleeps soundly.

This disorder is not very uncommon in men and women in the middle ranks, but seldom, if ever, occurs in children.

In men, it seems to be brought on by family cares, or anxiety in business, or over-fatigue, and is, I believe, most frequent between the ages of thirty-five and fifty. In women, it is most frequently the effect of profuse monthly discharges.

The disorder may continue for two or three months; and, in persons who have once had it, is very liable to be brought on again by trouble, over-fatigue, losses of blood, want of rest, or any other cause of exhaustion.

In the summer of 1846, the following notes were sent me respecting a medical man, practising in a country town, who was then between thirty-five and forty years of age:—

"About three hours after each meal—or perhaps about four or five hours are nearer the mark—and, as soon as digestion appears to be over, he is seized all at once with severe pain in the stomach, which soon becomes so intense as to depress the circulation in a very remarkable way. The pulse falls to 35 in a minute: he becomes deadly pale; his hands and feet grow cold; and all his strength appears to have left him. This state of things continues until he gets something to take in. But the very moment he swallows anything —and what is remarkable is, that the effect seems to be quite independent of the nature of the aliment,—he gets complete relief until the period comes round when the stomach is again empty. In the absence of food, the pain is much assuaged by his assuming the recumbent posture.

"For the rest, his appetite is perfectly good; he does not suffer at all from thirst: and his bowels are regular as the day. The evacuations perfectly healthy in appearance. At times, the stomach becomes enormously distended with wind, but this is not generally the case at the time of the paroxysm. He never vomits; never has nausea, water-brash, or heart-burn. Sleeps well. He is a good deal alarmed about himself, but still not nearly particular enough, either in his diet or in his way of life generally."

Since the time when this letter was written the gentleman to

whom it relates has had several illnesses of the same kind, most of them brought on by fatigue.

This disorder, like other functional disorders, occurs in various degrees. In some cases so slight as to be little complained of; in other cases causing as much suffering for a time as the worst kinds of organic disease.

It may generally be distinguished readily, even when most severe, from organic diseases of the stomach, by the circumstance, that the pain and tenderness exist only, or are greatest, when the stomach is empty of food, and that they are removed or lessened by eating or by lying down.

In cancer of the stomach and in simple ulcer—the painful organic diseases of the stomach—there is generally constant uneasiness in the stomach, and the pain and tenderness are almost always greatest when the stomach is distended with food. This disorder is, as I have stated, closely allied to water-brash. Like water-brash it occurs, I believe, chiefly in grown-up persons who have been exposed to exhausting influences; and, as happens in water-brash, the pain comes on in paroxysms when the stomach is empty, and in the intervals of the paroxysms the patient may both eat and digest.

Its affinity with water-brash is shown more clearly by the occasional occurrence of vomiting or of the eructation of a thin fluid from the stomach during the paroxysm of pain.

The disorder differs from water-brash in the circumstance that there is seldom any liquid rejected from the stomach, and that the pain is more severe and attended with more depression than the water-pang usually is.

The pain is probably caused by unhealthy and irritating secretions from the mucous membrane.

The medicine I have found of most use in this disorder is hydrocyanic acid, given in full doses. Opium is likewise of service, but is, I believe, generally less effectual than hydrocyanic acid.

Much benefit often results also from preparations of iron, especially citrate of iron, of which from three to five grains may be given, dissolved in water, immediately after meals.

The disorder may sometimes be mitigated by alkalies and other medicines that increase and modify the secretions. On more than one occasion I have known it speedily remedied by small doses of the gray powder.

Bismuth, nitrate of silver, and other medicines that have an astringent influence on the coats of the stomach, are of much less service than in water-brash.

The patient should live on a light but nutritious diet, have regular meals and plenty of sleep, and should avoid fatigue, and, as much as possible, other causes of exhaustion.

When the paroxysms of pain have ceased to recur, quinine and other tonic medicines may generally be given with much advantage.

Among the dispensary patients in London there is a common form of dyspepsia, closely allied to those we have just considered, the result of exhaustion, and brought on by deficient food, excessive labour, want of sleep, and trouble. It is much benefited by small doses of opium, and by steel.

Another variety of indigestion that may be classed with those we have lately considered is the indigestion of drunkards.

The chief characters of this are want of appetite, and vomiting, or dry retching, in the morning, with a white or furred tongue, and a slow pulse. The power of digestion is much enfeebled, and if the patient eat at any time what for others would be a very moderate meal, he is apt to vomit soon afterwards, and to be troubled by pain in the stomach and flatulence.

This disorder, like the vice from which it springs, is most frequent in men of middle age, and is generally associated with more or less of that strange and peculiar disturbance of the nervous system which hard drinking brings on, and of which the most striking effects are, inability to sleep, or sleep broken by frightful dreams, despondency in the morning, and tremulousness of the hands and tongue.

The vomiting, at first, may occur only in the morning; but after a time the health gets broken, and vomiting may occur frequently at other times of the day.

Spirit-drinking often induces an inflammatory or catarrhal condition of the mucous membrane of the stomach, which may give rise to flatulence and other disorders of digestion; and it now and then causes, as I have before stated, minute superficial ulcers of the mucous membrane of the stomach, which may account for the pain that is sometimes felt after meals, as well as for the fact that the morning vomit of the drunkard sometimes contains small clots or streaks of blood.

It now and then causes also adhesive inflammation of the submucous cellular tissue of the stomach, especially near the pylorus, which leads to stricture or narrowing of the pyloric orifice, and to all the evils that result from that condition.

But the gastric disorder we are considering may occur without either of these events, and when the stomach, in case of death, may exhibit no striking marks of disease.

The disorder may, in most cases, be readily distinguished by the peculiarity of its symptoms, when the habits of the patient are known; but it is sometimes much more severe than I have represented it, and may then lead for a time to the suspicion of incurable organic disease. For months together the patient may have no desire to eat, and may vomit at any time of the day after food has been taken, and of course falls away greatly in flesh and strength. In such cases, it is requisite to watch the progress of the disorder and the effect of remedies upon it, to say positively what its nature is.

The same form of indigestion, like the peculiar nervous disorder with which it is associated, now and then occurs in persons who do not drink to excess, but whose nervous systems are exhausted by mental anxiety, fatigue, or want of food. Anxiety and over-fatigue take away the appetite, impair digestion, and often prevent sleep. If the influence of either of these conditions be continued, and there be no sleep for several successive nights, and no solid food be eaten for several successive days, a state bordering on delirium tremens often comes on. The nights are disturbed by spectral illusions, the hands and tongue tremble, the appetite is quite gone, and vomiting is apt to occur in the morning, or at other times of the day if food be taken.

The exhaustion from want of food sometimes leads to similar results.

This kind of disorder is very common among the poor in London, especially among the women—among those even who do not drink largely. It is brought on by the conditions I have just specified, aided, no doubt, in very many cases, by the use of stimulating drinks.

Like delirium tremens, it may also be brought on by excessive depletion, or by the shock of severe injuries or operations. I have known it caused by fright.

The most efficient remedies for this disorder are bitters, opium, and solid food.

In all the public-houses for drinking bitter tinctures are kept, and the drunkard takes a glass of these "bitters" as his morning dram. He finds that it strengthens and settles his stomach and gives some little appetite for the morning meal.

Gentian, quassia, and calumba are the bitters most commonly used, and they may be taken, singly or combined, two or three times

a-day, an hour before the principal meals. They are generally taken, and are most relished, in the form of tincture.

Opium is of still greater benefit. It tranquillizes the nervous system, procures sleep, and, by so doing, settles and strengthens the stomach.

The weakness of the stomach is in great measure the result of the general disorder of the nervous system.

This is more strikingly seen in that higher degree of nervous disorder that constitutes delirium tremens. While the delirium exists, and the nights are passed without sleep or in sleep that is broken by frightful dreams, there is total inability to eat; but the appetite generally returns when the nervous system has been refreshed by sleep. Opium, by giving this refreshing sleep, remedies, indirectly perhaps, but more surely than any other medicine, the gastric disorder.

In the cases we are considering, where the more prominent symptoms are those of the gastric disorder, small doses of opium, or of morphia, may be usefully combined with the bitters. In most cases small doses of opium so given are sufficient, if the patient give up the destructive habit of drinking, to restore, after a time, the tone and power of the stomach. But it now and then happens, where the gastric disorder is severe, that very large doses of opium are required to control it.

In January, 1849, a man, fifty-two years of age, was brought into King's College Hospital in this condition. He had long been of very intemperate habits, and, for some time before his admission to the hospital had vomited a portion of almost every meal. He was weak, and generally out of condition, and had very little appetite, and a white flabby tongue, and a pulse generally under sixty, sometimes under fifty in a minute, and slept badly. After taking food of any kind he had a sense of nausea, followed in about ten minutes or a quarter of an hour by the rejection of part of the food. He had occasionally severe pain in the stomach, and water-brash; but the stomach was not generally either painful or tender.

Bismuth, nitrate of silver, and hydrocyanic acid, were tried without benefit. The symptoms were somewhat mitigated by quassia and gentian, and by small doses of the liquor opii sedativus; but no decided amendment took place until the middle of May, when the physician's assistant at the hospital, in my absence, prescribed for him half a grain of muriate of morphia, and five minims of dilute hydrocyanic acid, every four hours. This soon stopped the

vomiting and gave him a full measure of sleep, and the appetite returned. He continued to take the morphia in very large doses, in conjunction with hydrocyanic acid; steadily grew stouter and stronger; and, at the end of some weeks, left the hospital to resume his accustomed labour.

In all cases of this kind, as well as in delirium tremens, it is essential that the patient should eat as soon as possible some solid nourishing food. No medicines produce lasting benefit until solid nourishing food can be eaten.

When there is pain or soreness in the stomach after meals, and when what is vomited contains small specks or streaks of blood—leading to the inference that inflammation or minute ulcers of the mucous membrane exist, strict diet and effervescing draughts, with opium, are the proper remedies.

The kind of disorder we are considering is now seldom met with, except in the lower ranks of life. Half a century ago hard-drinking was common in the upper classes, and men of fortune were often sent to Bath to restore the tone of their stomachs by drinking its waters. Heberden classed these waters among the specific remedies. He says,—"The honour of this title (of specific) may be justly claimed by the Peruvian bark for the cure of agues; quicksilver for venereal disorders; sulphur for the itch; and perhaps opium for some spasms; and Bath waters for the injury done to the stomach by drinking."[1]

The most common gastric disorders among the poor in London are water-brash, and want of appetite and feeble digestion, the result of exhaustion and drink.

Now and then another peculiar gastric disorder is met with, in which digestion is tolerably good in the morning, so that a substantial breakfast causes no discomfort; but if a hearty meal be eaten in the after-part of the day, it is followed by distressing flatulence and pain at the stomach, which sometimes ends in vomiting, and sometimes, after continuing several hours, gradually subsides, without vomiting, as the stomach gets empty of gas. This variety of gastric disorder occurs most frequently in the decline of life, or in persons whose circulation is languid and who are readily fatigued; and the weakness of digestion is in great measure owing to debility or exhaustion.

In such cases, half a drachm of aromatic spirits of ammonia, or five grains of carbonate of ammonia, may be given with advantage

[1] "Commentaries," p. 69. Third Edition.

three times a day; and from five to ten grains of bismuth, just before dinner.

The patient should, of course, take his most substantial meal in the morning, when digestion is strongest; should be at rest in the recumbent posture for a couple of hours in the middle of the day; and should carefully avoid fatigue.

LECTURE XIV.

Symptoms of stomach disorders—Pain and soreness at the epigastrium—Vomiting—Excessive acidity—Flatulence.

We have now considered the principal diseases and derangements of the stomach that have been yet distinguished.

It appears that many of the most striking symptoms presented to our notice—namely, pain and soreness at the epigastrium, vomiting, excessive acidity of the stomach, flatulence—may result from very different conditions. It may, therefore, be not uninstructive to pass these symptoms in review for the purpose of discovering what peculiarities they present in the different circumstances under which they occur.

Pain and soreness at the epigastrium exist in most of the organic diseases of the stomach—in cancer, in simple ulcer, and in all active inflammatory states of the mucous membrane,—but they often exist in as high and even in higher degree in disorders that are not dependent on any striking organic changes, and that are usually regarded as merely functional: for instance, in the sympathetic disorder of the stomach that occurs in phthisis and other diseases, and in water-brash and the kindred disorders we have lately been considering.

When the pain and soreness depend on the organic diseases I have mentioned, they are almost always more severe soon after meals or when the stomach is full, than at other times, and are usually much more severe after a heavy meal of animal food and fermented drinks than after a light one of farinaceous substances and milk.

When the pain and tenderness are the result of functional disorder, they sometimes occur only when the stomach is empty, and are relieved by food, no matter what. The pain seems to be excited by unhealthy secretions from the mucous membrane, or by some ir-

ritating products of digestion, and abates when these are diluted by food.

The distinction between pain that is most severe soon after meals, and pain that is only felt or is most severe when the stomach is empty, is of great importance in practice.

When pain occurs soon after meals, or when the stomach is full, the greatest relief is usually given by a light, that is, an easily digestible diet. When pain is felt only when the stomach is empty, it is most effectually controlled by sedatives, and, if the pain be attended by undue secretion from the mucous membrane, by bismuth and other medicines which act immediately on the secreting surface, and by avoidance of fatigue and other causes of exhaustion, by proper regulation of the time of meals, and by steel.

The pain of organic disease cannot be distinguished by its character from that which results from functional disorder, but in certain circumstances uneasy sensations of peculiar character, and different from ordinary pain, are often felt in the stomach.

When the secretion of gastric juice is scanty, and digestion in consequence slow, there is an uncomfortable feeling in the stomach, which is generally described as a sense of weight and oppression.

The uneasy sensation in pyrosis, when the fluid eructated is alkaline, is generally described as pain with a sense of constriction at the stomach.

A similar feeling of constriction is sometimes felt in cases of flatulent distention of the stomach, and especially, according to Dr. Prout, when the gas distending the stomach is nitrogen.

A solid morsel of undigested food, in passing through the pylorus, excites a distressing sensation generally described, and perhaps rightly described, as *cramp* in the stomach.

The feelings of constriction and of cramp seem to result from strong spasmodic contraction of the muscular fibres of the stomach, especially of those near the pyloric outlet.

Vomiting is a more frequent disorder than pain and soreness at the stomach, and is brought on by a far greater number of conditions. Pain and soreness seldom exist unless there is something amiss in the coats of the stomach itself or in its secretions, but vomiting occurs in numberless instances where the stomach is nowise in fault.

Magendie long ago proved that if the pylorus be closed, vomiting may be brought on by sudden pressure on the stomach, without any

muscular action of the stomach itself. He found, indeed, that vomiting could be excited in dogs, by injecting tartar-emetic into their veins, when the stomach had been removed and a pig's bladder connected with the œsophagus had been substituted for it.

The conditions under which vomiting occurs may be ranged in the following classes:—

1. Organic diseases of the stomach itself.
2. Some mechanical impediment to the passage of the food out of the stomach, or in its subsequent course through the bowel.
3. A source of irritation in some other organ affecting the stomach by nervous sympathy.
4. Morbid states of the blood.

When vomiting results from organic disease of the stomach,—from cancer, from simple ulcer, or from inflammatory states of the mucous membrane—it usually coexists with pain in the stomach; and the vomiting is generally rendered much less frequent, and the pain less severe, by eating little at a time and by abstaining from food which, from its quality or form, is irritating or oppressive to the stomach.

When vomiting is brought on by food, and occurs constantly soon after food is swallowed, and especially if the vomiting be attended with pain, nothing usually gives so much relief as allowing the patient to eat only food of the lightest kind and in very small quantity at a time. Benefit may likewise result from a blister applied to the epigastrium, and from some absorbent powder—as bismuth, magnesia, or charcoal—taken a short time before meals; but when there is any ulceration or abrasion of the mucous membrane, hydrocyanic acid and creasote, which have great efficacy in some other kinds of vomiting, generally do harm. As I have before intimated, proper regulation of the diet is usually the most effectual means of relief. In some cases when its mucous membrane is inflamed or the seat of numerous minute superficial ulcers, the stomach is intolerant of food of any kind, and vomiting can only be arrested by a long fast. An intolerance of food arising from a state of inflammation of the mucous membrane, or from the presence of minute superficial ulcers, sometimes exists for a long time, the stomach being continually fretted, and the morbid state kept up, by food which it cannot digest.

In children and in young unmarried women cases now and then occur, in which much of what is eaten is very soon vomited, for

weeks or months together, so that great wasting and debility ensues, without there being any discoverable source of irritation in any organ apt to affect the stomach by sympathy, or any unhealthy condition of the blood. The vomiting appears to arise from an irritable condition of the stomach itself, and the disorder may sometimes be speedily cured by allowing the patient to eat only milk, with some farinaceous substance, in very small quantities at a time.

In the fifth volume of "The Medical Observations and Enquiries," published in 1784, there is an interesting paper on this subject, which brings before us two of the most distinguished members of our profession of that time. The paper is by Dr. William Hunter, and entitled "The successful Cure of a Severe Disorder of the Stomach, by Milk, taken in Small Quantities at Once." It gives a graphic account, apparently from memory, of a case that fell, many years before, under Dr. Hunter's observation.

"Many years ago," Dr. Hunter says, "a gentleman came to me from the eastern part of the city, with his son, about eight or nine years old, to ask my advice for him. The complaint was of great pain in the stomach, frequent and violent vomitings, great weakness and wasting of flesh. I think I hardly ever saw a human creature more emaciated, or with a look more expressive of being near the end of all the miseries of life. The disorder was of some months' standing, and, from the beginning to that time, had been daily growing more desperate. He was at school when first taken ill, and concealed his disorder for some time; but growing much worse, he was obliged to complain, and was brought home to be more carefully attended. From his sickly look, his total loss of appetite, besides what he said of the pain which he suffered, but especially from his vomiting up almost everything which he swallowed, it was evident that his disorder was very serious.

"Three of the most eminent physicians of that time attended him in succession, and tried a variety of medicines without the least good effect. They had all, as the father told me, given the patient up, having nothing further to propose." . . . . "He was stripped before the fire, and examined with attention in various situations and postures; but no fulness, hardness, or tumour whatever could be discovered: on the contrary, he appeared everywhere like a skeleton covered with a mere skin; and the abdomen was as flat, or rather as much drawn inwards, as if it had not contained half the usual quantity of bowels."

The advice which Dr. Hunter gave to the father was this:—

"Take your son home, and as soon as he has rested a little, give him *one* spoonful of milk. If he keeps it some time without sickness or vomiting, repeat the meal; and so on. If he vomits it, after a little rest try him with a smaller quantity, viz., with a dessert or even a teaspoonful. If he can but bear the smallest quantity, you will be sure of being able to give him nourishment. Let it be the sole business of one person to feed him. If you succeed in the beginning, persevere with great caution, and proceed very gradually to a greater quantity, and to other fluid food, especially to what his own fancy may invite him; such as smooth gruel or panada, milk boiled with a little flour of wheat or rice, thin chocolate and milk, any broth without fat, or with a little jelly of rice or barley in it, &c."

Dr. Hunter further adds:—"I heard nothing of the case till, I believe, between two or three months after. His father came to me with a most joyful countenance, and with kind expressions of gratitude told me that the plan had been pursued with scrupulous exactness, and with astonishing success—that his son had never vomited since I had seen him—that he was daily gaining flesh and strength, and colour and spirits, and now grown very importunate to have more substantial food. I recommended the change to be made by degrees. He recovered completely; and many years ago he was a healthy and very strong young man."

In an appendix to this paper is a letter from Mr. William Hey, of Leeds, giving a short account of four other cases, in which, for periods varying in the different cases from ten days to twelve months, vomiting had constantly occurred after meals, and which, acting on a hint given him by Dr. Hunter, Mr. Hey had treated with much success by a diet consisting solely of milk and bread, in small quantities at a time.

The subjects of these cases were all young. The first was a girl of eleven, the second a girl of eighteen, the third and fourth schoolboys, whose ages are not stated. In none of these cases is there any mention of pain in the stomach, which was a prominent symptom in Dr. Hunter's case, but there are other circumstances that point to the stomach itself as being most probably the original source of disorder. In the first case, for example, it is stated that after an emetic, consisting of four grains of powdered ipecacuanha, there was *vomiting of blood*, which continued at intervals the whole day: in the second case that vomiting, though always occurring after meals, frequently occurred at other times, and that then *mucus* was brought

up: in all the cases, that rapid amendment followed the restriction of the diet.

I have met with several cases similar to those which thus excited the attention of Dr. Hunter and Mr. Hey—cases, that is, in which vomiting almost constantly occurred after meals, for a long time, in young persons, in whom I could discover no condition apt to affect the stomach by sympathy; and in which cases, consequently, I have been led to attribute the vomiting to a morbid condition of the stomach itself. The chief disorder is an intolerance of food, and this may continue for a long time without much pain in the stomach, without fever, and even without impairment of appetite. In a case of this kind, recently under my care, a small quantity of blood had been vomited more than once.

The only active morbid conditions of the mucous membrane of the stomach in young persons that we know of, is that state, or those states that we designate inflammation; the simple, or perforating, ulcer; and superficial ulcerations, or erosions, of the mucous membrane. The disorder cannot depend on the simple or perforating ulcer, for this kind of ulcer causes less frequent vomiting and greater and more circumscribed pain than usually exists in such cases, is much more difficult of cure, and has not hitherto been found in persons so young as some of the subjects of this disorder are. The most probable supposition is, that the disorder depends on a catarrhal state, combined perhaps in some cases with small superficial ulcerations, or erosions, of the mucous membrane. These may result from irritation of the membrane by hard or indigestible substances, or from inflammation of it excited in other ways, and may be long prevented from healing by continual irritation from food. This supposition accounts for the great length of time the disorder may continue, and the rapid amendment that commonly takes place when the patient is allowed to eat nothing but milk, with some farinaceous substance, in very small quantities at a time.

Whenever the stomach is very intolerant of food, in consequence of a morbid state of its mucous membrane, the food should always be liquid, or pulpy, since a *solid* morsel of any kind may, by mere mechanical irritation, bring on a recurrence of the vomiting. During convalescence from cholera, and in many other states, an unnatural irritabi ity of the stomach may be kept up for some time by want of attention to this point.

So much for the vomiting that results from morbid states of the stomach itself.

The vomiting that results from a mechanical impediment to the passage of the food out of the stomach or in its subsequent course through the bowel, may often be distinguished by the time of its occurrence, or by the quantity or character of the matters vomited, and by the co-existence of the vomiting with other significant symptoms.

When, for example, the pylorus is strictured, or there is any other abiding impediment to the passage of food through it, the stomach gets permanently enlarged, and part of its lower outline may sometimes be seen through the wasted walls of the belly. Vomiting occurs, for the most part, when the stomach is full, and the quantity then vomited is large. The vomiting often occurs in the evening, and nearly as much is thrown up as the patient has eaten in the day. When the stomach is greatly enlarged, two or three days may pass without vomiting, and then an enormous quantity be rejected at once.

There are no means of preventing vomiting of this kind if the pylorus be very much narrowed. When the impediment to the passage of food out of the stomach is slight, much good may be done by proper regulation of the diet, which should consist chiefly of liquids that can be absorbed in the stomach, and of substances that are easily dissolved or softened, and may so pass readily through the narrowed outlet.

When there is an impediment in the small or in the large intestine, what has been described as an antiperistaltic motion takes place, and the contents of the intestine are returned into the stomach and then rejected. It would be unwise to attempt to restrain this vomiting until the obstruction that caused it is removed.

When efforts of vomiting are straining and frequently repeated, without any obstruction in the course of the bowel, the contents of the duodenum are forced into the stomach and rejected. What is thrown up has the colour and the bitter taste of bile. The bile is not forced into the stomach by pressure on the duodenum from without—which would tend to force the bile downwards as well as upwards, and could hardly empty the duodenum—but by the action of the muscular fibres of the duodenum itself. It sometimes happens that after hard efforts of vomiting, when the stomach is empty, a small quantity of liquid is thrown up, consisting almost entirely of bile. No external pressure that can be produced by the diaphragm and abdominal muscles could effect this without the aid of muscular action in the intestinal canal itself. It would seem, then,

that in hard and straining efforts to vomit, the so-called antiperistaltic action extends from the stomach to the portion of intestine immediately below it. Vomiting of bile generally indicates that the efforts of vomiting have been hard and straining, but seldom signifies anything more.

When vomiting results from a source of irritation in some other organ affecting the stomach by nervous sympathy, it is immediately excited by a sense of *nausea*, and is usually unattended by pain at the stomach, unless the irritation that causes the vomiting, causes also an untimely or excessive secretion of gastric acid.

This kind of vomiting is sometimes more distressing and more uncontrollable than any other. A feeling of nausea that is unceasing, and vomiting that nothing will stop, occurring immediately after anything, the simplest drink even, is swallowed, and continuing day after day till the patient nearly dies of exhaustion—seldom depends on organic disease of the stomach, but may arise from the strangulation of a portion of omentum, from a calculus sticking in the ureter or the common gall-duct, from pregnancy or some uterine irritation, from inflammation within the head, and even, as most travellers know, from the mere movement of a ship at sea.

This terrible disorder may continue a considerable time without any serious damage to the stomach itself. When its exciting cause is removed, the vomiting, before uncontrollable, may cease at once, and the full power of the stomach be speedily restored.

This kind of vomiting may often be distinguished by the knowledge that some condition that is apt to cause such disorder of the stomach exists, and by the absence of pain and soreness at the epigastrium, or, if there be pain, by the rejection of a large quantity of acid, which may account for the soreness and pain. In some cases, the very urgency of the vomiting, and the unceasing feeling of nausea, may lead to the inference that the disorder does not originate in the stomach itself.

If, in such cases, there be no undue secretion by the mucous membrane, the vomiting may sometimes be alleviated by sedatives. If there be an untimely or excessive secretion of gastric acid, by far the best remedies are alkalies, bismuth, and the vegetable astringents. I need hardly observe that whatever lessens the original irritation will mitigate the gastric symptoms. The gastric disorder in phthisis, for example, is usually much mitigated by whatever lessens the violence and frequency of the cough. In some cases of this sympathetic disorder, as I have already observed, nothing will

stop the vomiting while the condition that excites it continues to act.

The vomiting that arises from unhealthy states of the blood is likewise attended with a feeling of nausea. It is associated with a depraved secretion from the mucous membrane—most probably with the elimination of some noxious matter through it,—and when the food is not rejected the digestion is commonly slow and imperfect, and flatulence and other evils of slow and imperfect digestion exist. When the gastric disorder exceeds a certain limit, it is apt to be followed by an analogous disorder of the bowels, which is probably excited in the same way—namely, by the elimination of some of the same noxious matter through their mucous membrane.

Disorder of the stomach, seemingly arising in this manner, very often occurs in granular disease of the kidney. In such cases, the clue that guides to its source is the unnatural condition of the urine, and the disorder may often be much alleviated—

1. By measures directed to the stomach itself,—by suiting the diet to the power of digestion, and by hydrocyanic acid, or small doses of creasote, given just before meals;

2. By the horizontal posture, and other measures that favour the action of the kidney;

3. By keeping up a free action of the skin where it is possible to do so; and

4. If these means should fail, by giving a few purgative doses of the compound jalap powder, or some other medicine of similar action, which, as I have before observed, most probably relieve the gastric disorder by ridding the system of noxious matter through the drain it causes from the intestinal canal.

A disposition to vomiting is always much increased by a costive state of the bowels, and in almost all cases in which obstinate vomiting does not originate in a morbid condition of the stomach itself and anything approaching to constipation exists, good will result from keeping the bowels freely open by such purgatives as do not offend the stomach. No medicine is so generally useful for this purpose as small doses of sulphate of magnesia, or, if there be an excess of acid in the stomach, of sulphate of magnesia and carbonate of magnesia together, which, under the circumstances I have just mentioned, is one of the best anti-emetics we possess.

Excessive acidity of the stomach is another very common effect of the organic diseases and functional disorders of this organ.

It has been shown by the experiments of Dr. Beaumont and

others, that when the stomach is empty the fluid that moistens its surface is slightly alkaline or neutral. The gastric juice, which is secreted by the coats of the stomach on the contact of food, seems to consist mainly of a peculiar organic principle derived from the coats of the stomach, to which the name "pepsin" has been given, together with muriatic acid, or with muriatic acid in conjunction with a certain quantity of lactic acid.

This acid fluid, the gastric juice, is nature's solvent for the nitrogenous constituents of the food, and the acid it contains is an essential constituent of it. It has been shown that the juice loses its solvent power if its acid be neutralized by carbonate of potash, but recovers it again on the addition of a proper quantity of muriatic or of lactic acid, which, in the experiments on artificial digestion, are the only acids that have been found to make with the mucous membrane of the stomach an energetic digestive fluid.

The gastric juice gradually dissolves the food, and in so doing loses its solvent power; but it does not lose its acidity in the stomach. On the contrary, as the food becomes more and more digested, the acidity of the gastric fluids increases. The acid passes out of the stomach with the chyme, and the portion of it that is not absorbed is then neutralized by the alkaline secretions of the liver, the pancreas, and the intestine itself. Repeated observations have shown that the contents of the small intestine some way down are generally slightly alkaline or neutral.

It is right, then, that while the stomach is empty of food, it should contain no free acid; and that the acid which is requisite for digestion and which is secreted by the glands of the stomach on the contact of food, should, after performing its office, pass into the duodenum, and in its course through the intestine be either directly absorbed or be neutralized by the alkaline fluids with which it is then mixed. But in various derangements of the stomach the gastric acid is often secreted at unseasonable times, or in too great abundance; or other acids are formed in considerable quantity in the stomach from the food, and the contents of the stomach are, in consequence, unduly acid.

Acid may get into the stomach in three ways:—

1. It may be poured out by the glands of the stomach.
2. It may be taken in the food.
3. It may be generated from the food in the stomach by some fermentative process.

The glands of the stomach only secrete, as far as we know, mu-

riatic acid,[1] perhaps lactic acid, and, in certain circumstances, carbonic acid. There may be generated in the stomach by different fermentative processes,—lactic acid, acetic acid, oxalic acid, butyric acid, carbonic acid, and probably many others.

The acids that cause excessive acidity of the stomach are the muriatic and the lactic, singly or combined. Acetic acid is formed more rarely; oxalic and butyric acids in too small quantity to produce this effect; and carbonic acid seems to be only troublesome or injurious from the flatulent distention it occasions.

We have seen that there are many conditions which lead to an excessive or untimely secretion of gastric acid.

Spallanzani and Dr. Beaumont collected gastric juice for some of their experiments by mere mechanical irritation of the inner surface of the stomach; and there can be little doubt that the irritation resulting from a simple ulcer, or from cancer affecting a small portion of the stomach, or from the presence of some hard or indigestible substance when the stomach is sound, often causes an excessive secretion of gastric acid, or the secretion of gastric acid when there is no food in the stomach to dissolve.

A source of irritation in some other organ that can affect the stomach by a reflex nervous influence, like direct irritation of the stomach itself, may cause an outpouring of gastric acid, when the stomach is empty of food. Proof of this may often be had during the passage of gall-stones through the gall-ducts; in the gastric disorder so common in organic diseases of the brain and in tubercular disease of the lung; and in various other conditions.

Again, excessive secretion of gastric acid may result from some fault, either inherited or acquired, in what have been termed the secondary assimilating processes, leading to certain unhealthy conditions of the blood. This is seen most distinctly in gouty persons and in men of middle age who have led the life that disposes to gout. The excessive acidity of the stomach to which such persons are prone seems to result, for the most part, from excessive secretion of gastric acid; and according to Prout the predominating acid in them is the

[1] Bidder and Schmidt appear to have finally proved that muriatic acid is the essential acid of the gastric juice, as Prout, and more recently Liebig maintained. Lactic acid is often present, but is not essential, and is probably in most cases developed from the food. The way to settle this point is to analyze the acid fluid that is sometimes repeatedly thrown up during the passage of a billiary or renal calculus, and in other circumstances, long after the stomach has been completely emptied of food and of the products of digestion.

muriatic. It is possible that in certain other morbid states of the general health, lactic acid, which we know to be a constituent of the muscles, and which is eliminated by the kidneys, may be secreted by the stomach in great quantity: but no proof has been given that such is the case. We have no ready means of distinguishing lactic acid, and when much lactic acid has been found by analysis in matters vomited, it must, except under peculiar circumstances, be very difficult to say that this acid was secreted by the coats of the stomach, and not formed in the stomach, as we know it may be in large quantity, from the saccharine elements of the food.

Acids are, as we have seen, often formed from the food in the stomach, by some fermentative process. This does not happen in healthy digestion, since healthy gastric juice, in sufficient quantity for digestion, prevents lactic and other acid fermentations of the food. But if the gastric juice be unhealthy or be secreted too sparingly, or if from obstruction of the pylorus or otherwise the food be too long detained in the stomach, it often happens that digestion is disordered and that there is set up in the stomach some fermentative process by which great quantities of acid are generated. This is especially the case, as Lehmann has asserted, in catarrhal states of the stomach; when, while the solvent juice is poured out sparingly, an unhealthy mucus is secreted, which rapidly decomposes and acts as a ferment for the food.

In cancer of the stomach all these conditions not unfrequently conspire; and when, in this disease, vomiting occurs some time after meals, enormous quantities of acid are brought up that are probably formed, for the most part, by the lactic or some other acid fermentation of the food.

The kind of fermentation set up in the stomach depends on the nature of the food, and on the quality or stage of decomposition of the gastric mucus, so that in different cases different acids[1] and other products are formed.

When acidity of the stomach arises in this way it frequently happens that some gases are likewise formed, and flatulence coexists with undue acidity.

[1] "Fresh animal membranes, such as bladder and the lining membrane of the stomach, immersed in water in an open vessel, pass through certain successive stages of decomposition, and accordingly, in the first phase of their decomposition, bring a solution of sugar into the state of lactic fermentation; in the second, into mucous fermentation; and in the third, into vinous fermentation."—"Handbook of Chemistry," by L. Gmelin, published by the Cavendish Society, vol. vii., p. 99.

An excess of free acid, as Lehmann has shown, suspends or weakens the solvent power of the gastric juice, and thus puts a stop to stomach-digestion, or renders it slow and feeble. In the intensely sour matter that is sometimes thrown up in cancer of the stomach, may often be seen shreds of meat, eaten many hours before, still undigested.

When much acid exists in the empty stomach, or when, during digestion, acid is secreted or formed in excess, it causes a sensation of heat about the cardia, and sometimes along the œsophagus, which is familiarly known to gouty and dyspeptic persons as *heartburn*. This unpleasant sensation is known only to those who are habitually dyspeptic. There are probably few grown-up persons in the middle and upper ranks of society who have not occasionally felt it. That the sensation is caused by the acid is proved by the well-known fact, that magnesia, or soda, or any other alkali, taken in sufficient quantity to neutralize the free acid in the stomach, will at once remove it. In some cases free acid in the stomach causes not the sensation of heartburn, but pain in the stomach, more or less severe, often attended with flatulence and with a feeling of constriction or cramp. Gastralgia produced in this way is generally felt when the stomach is empty, or nearly empty, of food: and, according to Dr. Prout, the predominating acid in such cases is generally the *lactic*.

But the ill effects of excessive or untimely formation of acid in the stomach are not always confined to the stomach itself. The acid which passes out of the stomach into the duodenum may be more than the alkaline fluids with which it is mixed in its course down the small intestine can neutralize, and the free acid thus existing in the bowel may fret its mucous membrane so as to cause griping pain and purging. It is probable that chalk owes its well known power of checking some forms of diarrhœa, not merely to its astringent action on the coats of the intestinal canal, but also to its being an insoluble substance, which passes onwards and combines until it is completely neutralized with any free acid it may meet in its course.

It was observed by Dr. Prout that this disorder of the bowel is most frequently set up when the predominating acid in the stomach is the lactic; and he offered an ingenious explanation of the fact. "The muriatic acid," he says, "is derived from the decomposition of common salt in the blood. The acid is poured out at the inner surface of the stomach, and the soda that is set free passes to the liver, and is there excreted in the bile. When, therefore, the mu-

riatic acid has performed its part in digestion, and passed into the duodenum, it meets and combines again with its equivalent alkali contained in the bile. But when *lactic* acid is generated in the stomach in excess, it does not meet with an equivalent alkali, in the duodenum, and so frets and disorders the bowel."

This ingenious explanation has recently lost much of its force, since observations that seem trustworthy have led to the inference that the soda set free by the decomposition of common salt in the coats of the stomach is not all eliminated with the bile, as Prout supposed, but is in part cast off by the kidneys and other secreting glands, where it cannot again meet with its muriatic acid.

The fact that there is more frequently disorder of the bowel, with undue acidity of the stomach, when the predominating acid in the stomach is the lactic, probably depends in great measure on the circumstance, that the excess of lactic acid is commonly, if not always, owing to excessive lactic fermentation of the saccharine elements of the food which still goes on or is succeeded by some other fermentative process in the bowel itself.

But the mischief resulting from excessive or unseasonable formation of acid in the stomach does not always end here. In grown-up persons excessive acidity of the stomach and bowels often causes severe frontal headache. If the excessive acidity continue long, it lessens the secretion of the liver and of the skin, rendering the complexion sallow, and the skin harsh and dry; and causes, or at least is attended with, languor and disinclination for mental exertion, and, now and then, rheumatic pains in the limbs, in persons disposed to them, and various other uncomfortable feelings. All these remote disorders are doubtless attributable to noxious matters of some kind or other in the blood.

An excessive formation of lactic acid in the stomach may lead to impurity of the blood in various ways. The derangement of digestion that attends the excessive formation of acid, may give rise to the formation of other hurtful matters in the stomach itself, and also during the subsequent passage of the vitiated products of digestion through the bowels; and these hurtful matters and part of the uncombined acid may be directly absorbed by the blood-vessels, or possibly, as Dr. Prout suggested, they may be absorbed by the lacteals, and cause additional impurity of the blood by preventing the proper completion of the chyle. Again, as I have just stated, excessive acidity of the stomach frequently causes or co-exists with defective action of the liver, kidneys, and skin; and defective action

of these important excreting organs may obviously lead to further contamination of the blood.

Knowing, then, that an excessive formation of acid in the stomach may lead to impurity of the blood in so many ways, we can hardly wonder at the general or remote disorders which this condition sometimes induces.

The remedies for excessive acidity of the stomach will depend in some measure on its cause.

The excessive acidity of the stomach that results from a gouty condition of the system, like other manifestations of the gouty habit, is much more common in men than in women; and is most common in middle age, and in men of gouty families, or who have lived the life that disposes to gout—that is, who have eaten largely of animal food and drunk freely of malt liquors. The acid in excess in such cases, if Prout was right, is the muriatic. It seldom causes much pain in the stomach, or disorder of the bowels, and the result of it chiefly complained of is a sense of heat in the stomach, or heartburn. This uncomfortable feeling may be alleviated for the time by soda, magnesia, or any other antacid; but it is apt to recur, for months or years together, on any indiscretion in diet.

The proper remedies for this condition are those of the kindred disorders of gout: an occasional dose of blue pill and colocynth, to keep up free action of the liver and bowels; alkalies, to neutralize the excess of acid in the stomach, and to increase the secretions of the liver and the kidneys: colchicum; but, above all, habitual exercise in the open air, and spare living. In many cases great benefit will accrue from total abstinence from alcoholic drinks, which often cause undue acidity in irritable stomachs, and thus, and probably in other ways, render gouty disorders more frequent and severe. Where beverages of this class cannot be altogether dispensed with, those should be chosen which, like brandy and sherry, contain no free acid; and they should be taken sufficiently diluted, since the more concentrated they are, the more, as a general rule, they create acidity, and the greater is the direct injury they do to the stomach itself.

The excessive acidity that results from organic disease of the stomach, such as simple ulcer or cancer, is distinguished by the other symptoms that belong to those diseases, and is most effectually controlled by proper regulation of the diet, and by magnesia and bismuth, which will neutralize the excess of acid in the stomach and

tend to restrain undue secretion, without fretting, as the soluble alkalies might do, the surface of an ulcer, should any exist.

The undue acidity of the stomach that results from irritation elsewhere, is very commonly associated with vomiting, and may generally be distinguished by the symptoms that reveal the primary disease. The immediate effects of the excess of acid may be controlled by the proper administration of alkalies; but the most efficient remedies are those which act on the secreting surface—bismuth, the vegetable astringents, and in some cases the sulphuric acid. Alcoholic drinks generally aggravate the disorder and increase the acidity, and when taken at all should be largely diluted. Port wine, from being more astringent, often suits better than sherry.

Our treatment of acid indigestion would be much more unerring, if we had any ready and sure means of ascertaining whether the excess of acid in the stomach has resulted from a too abundant or an unseasonable secretion of the gastric acid, or whether it has been formed from the food in the stomach by the lactic or some other acid fermentation. The lactic and other acid fermentations result from feebleness of the digestive power, or from some obstruction at the pylorus or near it; and, as Lehmann has pointed out, are doubtless often promoted by a catarrhal condition of the mucous membrane, leading to a secretion of unhealthy mucus, which, when the gastric juice is insufficient, soon decomposes and acts as a ferment. The disorder, when there is no obstruction at the pylorus or elsewhere, is in delicate people of habitually feeble digestion often of long continuance. It is generally much aggravated by alcoholic drinks. The most effectual remedies for it, are, as I have already stated, a diet suited to the feeble power of digestion; warm clothing; mustard poultices frequently applied to the epigastrium; and bismuth and other medicines which exert an astringent action on the mucous membrane.

Another symptom that attends indigestion in its various forms is *flatulence.*

In healthy digestion no gas is generated in the stomach; but in some forms of indigestion gases of different kinds are evolved there, sometimes in great abundance, and give rise, according to their kind and amount and the previous condition of the stomach and chest, to various uncomfortable feelings.

There are three possible sources of flatulence:—

1. Air swallowed.

2. Gas generated from the food or secretions in the intestinal canal by some fermentative process.

3. Gas secreted or evolved by the coats of the intestinal canal from the blood.

When gases have got into the intestinal canal in either of the first two ways, an interchange of these with the gases of the blood may take place by endosmosis.

The air swallowed can only furnish, directly, oxygen and nitrogen, in the proportion in which they are contained in atmospheric air; namely, one volume of oxygen to about four of nitrogen. The only interchange of any amount that can take place in a moderate time between these gases and those of the blood, by endosmosis, is the interchange that takes place when atmospheric air is brought into contact with the capillaries of the lungs—that is, the exchange of a certain portion of its oxygen for about an equal volume of carbonic acid. The nitrogen of atmospheric air, which undergoes little change in amount even in respiration, must under ordinary circumstances remain almost unaltered, as far as any interchange by endosmosis is concerned. The blood is, indeed, always saturated with nitrogen, because nitrogen is constantly brought in contact with it in the lungs, and is not expended, as the absorbed oxygen incessantly is, in the system. It may be inferred, therefore, that the gases in the stomach resulting from air swallowed and changed only in this way, are one volume of oxygen and carbonic acid, combined, to about four volumes of nitrogen.

The only gases the blood contains are those of the inspired and expired air—oxygen, nitrogen, and carbonic acid,—and it is clear that oxygen, which is constantly needed in the blood, and which it is the business of respiration to supply, cannot be exhaled; so that the only gases that can pass directly from the blood into the intestinal canal, are nitrogen and carbonic acid.

It follows, therefore, that the only gases that can get into the intestinal canal from these two sources, are, oxygen, nitrogen, and carbonic acid; that oxygen can only be derived from air swallowed, and that its amount cannot be greater than in atmospheric air: namely, than one volume to four of other gases.

The gases furnished by fermentative processes in the intestinal canal, are carbonic acid, hydrogen, different compounds of hydrogen, and nitrogen. Lactic and the viscous fermentation may occur without any evolution of gas. Vinous fermentation evolves carbonic acid; butyric fermentation, carbonic acid and hydrogen; common

putrefactive changes generate these gases, nitrogen, and various compounds of hydrogen, such as sulphuretted hydrogen, carburetted hydrogen, and ammonia. While these gases are being evolved the quantity of oxygen in the intestinal canal, derived from the air swallowed, is gradually lessened by some of it entering into combination with other substances and some of it passing directly, without change, into the blood.

Stinking putrefactive changes—leading to the evolution of sulphuretted and carburetted hydrogen—require some time for their production, and are retarded by the acids of digestion, so that they seldom take place in the stomach, but are very common in the large intestine. When they do take place in the stomach, they are recognised by the eructation of the fetid sulphuretted hydrogen gas—the belching as of rotten eggs.

The gases evolved by the ordinary fermentative processes in the stomach, consist of carbonic acid and hydrogen, and of carbonic acid in greater amount than hydrogen.

The ordinary gases of the stomach are, therefore, oxygen, nitrogen, carbonic acid, and hydrogen. The oxygen is derived solely from the air swallowed, and its proportion to the other gases can never be greater, and must generally be very much less, than its proportion in atmospheric air. The hydrogen must be derived from some fermentative process, and must be much less in volume than the carbonic acid. So that when *distention* of the stomach occurs, it must be chiefly from nitrogen or carbonic acid; and if from carbonic acid, this must be derived for the most part from some fermentative process.

Magendie and Chevreul found in the stomach of a man, soon after execution, a gaseous mixture, consisting of 11 volumes of oxygen, 71·45 of nitrogen, 14 of carbonic acid, and 3·55 of hydrogen. As all the oxygen must have been derived from air swallowed, this accounts for about 44 volumes of nitrogen, and shows that at least 55 volumes in the 100 of the gaseous mixture consisted of atmospheric air that had been swallowed. If all the nitrogen was derived from air swallowed (as is probable,) it must have been mixed originally with about 17·86 volumes of oxygen, and supposing that the 6·86 missing volumes of this oxygen had been exchanged for an equal volume of carbonic acid, nearly nine-tenths of the gaseous mixture (71·45 of nitrogen, and about 17·86 of oxygen and carbonic acid combined) must have resulted from air swallowed. Of the remainder of the gaseous mixture, amounting to rather more than

one-tenth by volume (7·14 of carbonic acid and 3·55 of hydrogen,) the hydrogen was certainly, and the carbonic acid most probably, derived from some fermentative process.

When the gaseous mixture in the stomach is chiefly derived from some fermentative process, it consists, for the most part, of carbonic acid and hydrogen, or of these gases with nitrogen and some of the compounds of hydrogen.

The gases that are found in the *intestines* contain very little oxygen, and consist of nitrogen, carbonic acid, hydrogen, and the compounds of hydrogen, in varying proportions.

The effects of gases in the stomach depend, as I have said, on their kind and amount, and on the previous state of the stomach and chest.

A certain quantity of atmospheric air always passes into the stomach with the food and saliva, and there can be little doubt that it serves there some useful purpose. It is only when atmospheric air is swallowed in large quantity, or at unseasonable times, that it is productive of mischief: and it is probable that the mischief it does then results from its mere mechanical effect in distending the stomach and impeding its movements.

Carbonic acid, when it results from a fermentative process, is a proof of unhealthy digestion. It coexists with other unnatural products, but probably of itself only does harm, like atmospheric air, from its mere mechanical effect in distending the stomach.

When gas exists in certain amount in the stomach, it always causes an unpleasant feeling of distention, and sometimes a distressing sense of constriction or cramp. If the distention of the stomach be great, or if the stomach be the seat of simple ulcer or cancer, it often causes severe pain. Now and then, when the stomach is full, the eructation of the gas excites vomiting: the gas, in its explosion, seeming to bring up with it some of the liquid and solid contents of the stomach.

The symptoms are, of course, often attended with other evils arising from disordered digestion.

In persons who are asthmatic or who have a diseased or irritable heart, flatulent distention of the stomach often embarrasses the breathing or causes palpitation; and in bad sleepers, or when the quantity of gas is large, it greatly disturbs the sleep.

I have already stated that flatulent *distention* of the stomach generally arises chiefly from nitrogen or from carbonic acid. Dr. Prout assigned somewhat different effects to these two gases. He says, "From whatever source this gaseous principle (nitrogen) is

derived, it usually gives much annoyance: for while the carbonic acid gas, on account of its stimulating qualities, generally escapes from the stomach, the passive character of the azote, and the peculiar spasmodic constriction which usually accompanies its development, cause it to be retained there, and thus to add greatly to the miseries of the patient."

I do not know whether Dr. Prout had any more direct evidence in favour of this opinion than the well-known fact, that the large quantities of carbonic acid swallowed in soda water and other effervescing drinks, instead of oppressing the stomach, are sometimes very grateful to it.

Hydrogen and its compounds always result from an unnatural fermentative process, and, when they are formed, other hurtful products of unhealthy digestion are formed as well. They not only act mechanically, like atmospheric air and carbonic acid, in distending the stomach and impeding its movements, but may be absorbed into the blood, and exert an injurious influence upon it. The development of sulphuretted hydrogen in the stomach is almost always attended with headache and other symptoms of general disorder.

Gases, of whatever kind they may be, seem to become gradually absorbed in the intestinal canal. The flatulent distention gradually lessens, and often disappears entirely after some hours, when the intestinal canal has its natural contractility, although there may be no eructation or direct expulsion of gas. The absorption of the gases is favoured by the contractility of the intestinal canal, in consequence of which they are subject to pressure in addition to the common atmospheric pressure to which the whole body and the fluids within it are exposed: and the absorption of the gases must also be promoted by the secretions which are poured into the intestinal canal, and which, after serving their purpose, are again absorbed, carrying with them into the blood such proportions of the intestinal gases as they are able to dissolve.

Late researches lead to the inference that the amount of the secretions poured into the intestinal canal is much greater than has hitherto been supposed. Lehmann obtained a certain quantity of gastric juice from the stomach of a dog, and ascertained by experiment how much coagulated albumen it was capable of dissolving. From this experiment he calculates that to digest the food ordinarily consumed by a healthy man, something like four pounds of gastric juice must be secreted daily. Bidder and Schmidt, from their very elaborate researches, infer that the whole mass of fluids

poured into the intestinal canal from the blood in twenty-four hours, is equal to one-sixth of the weight of the whole animal, and that it far exceeds in quantity the whole mass of the blood itself. The fluids thus poured into the intestinal canal are, for the most part, again absorbed, and if their quantity at all approaches the estimate of these distinguished physiologists, and if the fluids at the time of their secretion are not much charged with gases, they must be capable of dissolving and carrying into the blood a large quantity of gas, should it happen to be present in the intestinal canal. This may account for the disappearance of nitrogen, which, since the blood is saturated with it, is only sparingly and under certain circumstances, absorbed directly from the air in the lungs.

It is often difficult in practice to tell the source of flatulent distention of the stomach, since the gases which the stomach commonly contains (oxygen, nitrogen, carbonic acid, and hydrogen,) and which are brought up by eructation, are inodorous, and cannot be distinguished by the taste. The source of the gas may be best ascertained by considering the circumstances under which the flatulence occurs.

One of the sources of flatulent distention of the stomach is, as we have seen, air swallowed. In addition to the quantity of air which necessarily finds its way into the stomach with the food and saliva, air is sometimes gulped into the stomach by certain spasmodic respiratory movements, and some persons have the power of swallowing great quantities of it at will. The opinion has been lately advanced, that the flatulent distention of the stomach so common in hysterical and hypochondriacal persons, which comes on suddenly from mental emotion, and gives rise to explosive bursts, originates in this way.

When there is no disorder of respiration, or of the nervous system that can thus account for the flatulence, it no doubt arises in most cases, if not in all, from some unnatural fermentative process in the stomach. It then occurs some time after meals, and is often associated with undue acidity or other evidence of disordered digestion.

Gas may be formed not only from the food, but also from mucous and other secretions of the stomach, when these are unhealthy or remain in the stomach too long; and this may account for the flatulence from which some persons suffer when the stomach is empty of food. Frerichs found butyric acid in the stomachs of a fasting horse and a fasting sheep.

Various aromatics—the so-called carminatives—have great effect in relieving flatulence, which they probably do chiefly by stimulating the stomach to contract, and thus expelling the wind.

When the flatulence is habitual and arises from some fermentative process in the stomach, more lasting relief is obtained by excluding from the diet, which should be suited to the power of digestion, all substances especially prone to ferment; by preventing constipation when a disposition to it exists, by the occasional use of some warm purgative; by the adoption of a healthy mode of life; and by medicines calculated to improve digestion. Great and immediate relief will sometimes result from small doses of creasote, taken at meal times, or from the bisulphite of soda, taken an hour or two after meals or as soon as the evolution of gas in the stomach begins to be felt.

LECTURE XV.

On some of the remedies for stomach disorders—Ipecacuanha—Bismuth—The vegetable astringents—Hydrocyanic acid—The alkalies.

HAVING now considered the various diseases and disorders of the stomach, it may perhaps be instructive to pass in review some of the means we have to remedy or relieve them.

I have before observed that we have greater power over the disorders of the stomach than over those of any other organ of equal importance.

In the first place, we can, for a time, lessen its work, and so lessen its vascularity, more than that of most other organs. The action of the lungs must go on without ceasing. The blood that has ministered to nutrition is returned from every part of the body to the lungs, and must there evolve the carbonic acid with which it is charged. Interruption of the process, even for a few minutes, is death. In the liver and in the kidney, an active process of secretion is always going on, and we have no power to arrest it, for however short a time. But, if needful, the stomach may be kept entirely without food for twelve or twenty-four hours, or longer still, and its work may be greatly lessened for a considerable time.

This power to give the stomach entire rest for many hours, and to lessen its work, and so lessen its vascularity, for a considerable

time, is of great avail in subduing or mitigating the inflammatory diseases to which it is subject.

Again, we can act by medicines more directly and more variously on the stomach than on any other organ. Our medicines are applied directly to it, and have, many of them, a direct local action upon its coats. Ipecacuanha, rhubarb, and ginger, increase its secretion, and bismuth, lime, and the vegetable astringents, restrain undue secretion, by their direct action on the secreting membrane. Opium, prussic acid, and carbonic acid allay pain and check vomiting, not only by their influence on the system at large, but also by their direct action on the nerves of the stomach itself. Ice-water, which is another powerful agent in controlling vomiting when this depends on an inflammatory condition of the coats of the stomach, acts directly by lowering the temperature of the stomach itself. Acids and alkalies, which are very efficient remedies in some kinds of gastric disorder, in addition to their more remote effects, have a direct action on the lining membrane of the stomach and on the fluids secreted by it. Carminatives, again, probably owe their efficacy chiefly to the immediate action they exert on the coats of the stomach.

We cannot exert such various direct action on any other organ. Medicines that are destined to act on most other organs can reach them only through the blood. They must, therefore, first be absorbed into the blood, and become diffused through it, and can only reach their proper destination little at a time. Indeed, much of what is administered may never reach its proper destination at all: it may be decomposed in the system, or be eliminated through other organs. If, for example, iodide of potassium be given to reduce the size of an enlarged gland, much of it may be decomposed in the stomach, or be eliminated by the kidneys and other secreting organs, before it has ever reached the diseased gland. But medicines that act directly on the stomach cannot miss their destination, and may be applied to it at once, in full measure, and without change. Some medicines even which are almost insoluble, such as bismuth and lime, act powerfully upon it.

There are several other circumstances that render the disorders of the stomach more remediable than those of many other organs.

The stomach owes its wonderful power to its mucous membrane, and when inflammation of this membrane occurs, the products of the inflammation, as happens with other mucous membranes, are poured out on its free surface, and seldom cause permanent change of its

texture. Again, the matters so effused have a ready outlet. They are not long pent up; they do not long remain in contact with the mucous membrane to irritate its surface, and thus to perpetuate the disorder from which they resulted—as I believe morbid secretions often do in the minute mucous tubes of the liver and the lung.

Again, the mucous membrane of the stomach, from having a more active secreting function, is more vascular, and has a more active nutrition than most other mucous membranes, so that injuries of its free surface are more readily repaired.

Another circumstance more favourable still is, that the stomach does not decay or suffer irreparable changes in structure, in the same degree as many other organs, by the mere effect of age.

All these circumstances serve to render the disorders of the stomach more remediable than those of any other organ of equal importance. But to remedy the disorders of the stomach we must distinguish their several forms, and know the kind of action which our medicines exert. Unless we do this, we shall often, by the wrong application of our means, aggravate the disorder which it is our object to remove. The number and the various action of our remedies will but render our practice the more uncertain.

I shall therefore say a few words on the action, and on the right application, of some of the more common remedies for the various forms of gastric disorder; and first of ipecacuanha.

Ipecacuanha increases the secretions of the stomach in greater degree, probably, than any other medicine we possess. It increases, as is well known, the secretion of the skin, and the secretion of the mucous membrane of the air-tubes; but it increases in much greater degree the secretion of the lining membrane of the stomach, to which it is directly applied. An emetic dose of ipecacuanha causes a copious secretion of mucus and of gastric acid, which is rejected by vomiting. Doses too small to excite vomiting or nausea increase the secretion of the gastric juice, and in so doing render digestion quicker and stronger. Its right application, therefore, is where digestion is slow, or where, through slow and feeble digestion, nettle-rash or other secondary disorders are bred.

Small doses of ipecacuanha were, I believe, first recommended as a remedy for indigestion in a tract published in 1785, by a French naturalist, M. Daubenton, well known from the aid he afforded Buffon in the production of his splendid work on natural history. Daubenton was educated for medicine, but left the practice of it for his favourite study of natural history. In the tract in which he recom-

mends small doses of ipecacuanha in digestion, he says, "I have repeatedly experienced beneficial effects from it in my own person that surpassed my expectations, and I have prescribed it to many others, with whom it has had similar success. I consider it, therefore, a duty to publish the observations on the utility of this simple remedy, for the benefit of those persons who have delicate stomachs, and as particularly useful in that form of indigestion, which is so frequently found to attend the turn of life."

Daubenton is careful in stating that the cases in which ipecacuanha is useful are where digestion is slow,—where the food lies heavy on the stomach and there is an inability for mental or bodily exertion for some time after meals,—a kind of disorder which is, he states, especially common in men of middle age, or beyond it, who lead sedentary lives.

He believed that ipecacuanha owes its efficacy in such cases to its exciting peristaltic action in the stomach, and imparting an energy to its glands.

He recommends that it should be given in the morning fasting, and in quantity sufficient to occasion a slight feeling of vermiculating motion in the stomach, but without causing any sensation of pain or nausea. The quantity requisite to produce this effect varies in different persons from a quarter of a grain to two grains. He advises, therefore, that very small doses be given at first, which may be gradually increased till a sensible effect is produced.

In the beginning of this century an English translation of Daubenton's tract was published by Dr. H. P. Buchan, and rapidly sold.

In the preface to this translation, Dr. Buchan says: "The translator of this little tract can truly declare, that since he became acquainted with the information contained in it, his practice in the complaints here enumerated has been more successful and satisfactory than it was previously, and his sole motive for publishing the translation, which was originally made for his own private use, is to extend the knowledge of what he conceives to be a practical improvement in the art of medicine."

Ipecacuanha, as a remedy for indigestion, being thus highly commended, was for a time much employed in this country, and then fell into disuse, in consequence, I believe, of its having been employed indiscriminately in various kinds of indigestion, and often, therefore, in kinds to which it is not suited, and which it would tend to aggravate rather than remedy.

It is clearly impossible that any medicine having a definite mode of action—whether it be to increase secretion or to restrain it—can

be used successfully in stomach disorders, unless the various kinds of stomach disorder be distinguished, and the medicine be given only in that kind, or in those kinds, to which it is suited. Here, as in other departments of medicine, we must rightly distinguish kindred disorders before we can learn the right use and the power of remedies.

I have used ipecacuanha as a remedy for indigestion for several years, and am satisfied that it often has much efficacy in removing the uneasiness and sense of oppression after meals and the various other evils that result from slow digestion.

Small doses of rhubarb, ginger, and pepper, have a similar kind of action, and may be given singly or together for the same purpose. I generally prescribe ipecacuanha, from half a grain to a grain, in a pill, with three or four grains of rhubarb. With many, a favourite remedy for the discomfort resulting from slow digestion is a grain of cayenne pepper, with three or four grains of rhubarb. The best time for giving medicines for the purpose in question is just before dinner, and before any other meal after which a sense of oppression is usually felt.

Another remedy more frequently used for indigestion than ipecacuanha, and of great efficacy in certain forms of it, but still given by many practitioners with uncertainty and doubt, is bismuth.

Bismuth was, I believe, first employed as a remedy for stomach disorders towards the close of the last century, by Dr. Odier, Professor of physic, in Geneva, who made known its virtues in a paper published in the "Journal de Médecine," in 1786, and entitled, "Sur les Effets du Magistère de Bismuth, donné intérieurement, comme Antispasmodique." In this paper Odier says, "Most of the patients who were cured by it were affected with cramp or violent pain in the stomach after meals. It is especially in such cases that I have found bismuth superior to all other remedies." And he adds, "It has also much success in stopping palpitations, pains in the stomach, and other nervous ailments in pregnant women." "It fails where the cramps in the stomach and other nervous ailments depend on some organic disease rather than on simple excess of irritability."

In 1801, a paper on the effects of bismuth was read to the Medical Society of London by Dr. Marcet, at that time one of the Physicians of Guy's Hospital, who tells us that he learnt the use of the medicine the year before at Geneva, from Dr. Odier.

Dr. Odier, in a note to Dr. Marcet, says: "I use this remedy with success in doses of six grains, four times a-day, in all cases of

spasms of the stomach, brought on by any kind of aliment, and proceeding only from the irritability of that organ. This complaint is extremely frequent at Geneva, particularly among servant-maids, who are in the habit of carrying water on their heads and make great use of their arms."

Dr. Odier assured Dr. Marcet that he had tried the medicine in much larger doses, and that he had never observed it to produce any ill effects; while, on the contrary, he had hardly ever known it to fail when used in the circumstances that have just been mentioned.

Dr. Marcet made trial of the medicine in London, and his experience confirmed the previous observation of Dr. Odier, that bismuth is a remarkably successful medicine in what were then vaguely termed spasmodic affections of the stomach.

Since that time it has been extensively used, often with very indefinite notions as to what it is capable of effecting, and, of course, with very various results. Amid the conflicting testimony respecting it, there is, however, ample evidence that it has real and great efficacy in some forms of gastric and intestinal disorder.

It is often of signal service, as Odier remarked, in the functional disorders of the stomach that are so common in women who are ill-fed and overworked, or exhausted in any other way, and especially where the stomach is very irritable, so that pain and vomiting occur soon after meals.

It is an efficient remedy when pain in the stomach, with increased secretion of gastric acid, occur from tuberculous disease of the lung or from some irritation elsewhere; and in infants, where this kind of disorder, with exhausting diarrhœa, results from the irritation of teething, or from improper food, or from the change of diet on weaning.

Against the pain in the stomach and vomiting that result from simple ulcer and other forms of organic disease, it is only of use occasionally, when the stomach secretes an unhealthy mucus, or when there is an excessive or untimely secretion of gastric acid.

It is of little use in the indigestion that depends on gout, and that occurs in well-fed and plethoric men.

It is of no use in the uneasiness of the stomach, of which I have before spoken, that results from slowness of digestion or a scanty secretion of gastric juice.

Bismuth, as applied to the stomach, was considered by Odier an *antispasmodic*. The action it exerts seems to be confined to the

mucous membrane with which it is brought into contact, and to be a *surface*-action. It restrains undue secretion, and has a sedative influence on the stomach, probably by its direct action on the coats of the stomach, as well as by preventing the out-pouring of irritating secretions.

It is best given, suspended in water, a short time before meals. Ten grains, three times a-day, is, in most cases, an efficient dose; but it may be given, as Odier discovered, in much larger quantity, without any ill effects. It is soothing, rather than irritating, to the mucous membrane over which it passes; and, from being of such sparing solubility, has little effect elsewhere, except what it has indirectly from the action it exerts on the stomach. It has, indeed, of late, been recommended by more than one writer to be given by drachms rather than grains.

Bismuth may often be given with advantage with other medicines, —with opium, or magnesia, or chalk,—which allay pain, or neutralize an excess of acid, or restrain undue secretion.

Chalk, and the vegetable astringents,—kino, catechu, krameria, and logwood,—are generally given to restrain diarrhœa. It does not seem to be generally known that they are just as effectual, perhaps more effectual, in restraining undue secretion from the stomach.

Chalk, like bismuth, from its sparing solubility, has little direct action, except on the mucous membrane over which it passes. The vegetable astringents have a more remote astringent influence. This is clearly seen in the colliquative state of phthisis; where, besides restraining the diarrhœa and stopping the vomiting with increased secretion of gastric acid that often occurs in this state, they restrain, often in a very striking degree, the profuse sweating.

They seem all to have much the same effect. I generally give the preference to krameria and logwood. Kino is not conveniently given in solution; and catechu is not only very nauseous, but, from being much used in the arts, is often of inferior quality. The most grateful to the taste is krameria; the most effectual, I believe, is logwood. Logwood has a mawkish taste, which is best corrected by cinnamon.

An ounce of logwood shavings, and a drachm and a half of powdered cinnamon, may be infused for four hours in ten ounces of boiling water, and then strained. An ounce and a half of the strained infusion may be given two or three times a day, a short time before meals.

Another medicine of great use in the treatment of stomach disorders is hydrocyanic acid.

The bitter almond and the cherry-laurel, which owe their efficacy to the hydrocyanic acid they contain, have been long used in medicine. Hydrocyanic acid, which was first separated by Scheele, in 1782, seems to have been first employed in its separate state, in Italy, about 1810, by Drs. Borda and Brera. It was little used elsewhere till 1817, when it was recommended by Majendie, (in a paper presented to the Académie des Sciences, Nov. 17, 1817,) as a remedy in diseases of the chest, especially consumption.

In this paper, Majendie arrives at the conclusion, fully justified by subsequent experience, that dilute hydrocyanic acid may be employed with advantage to restrain nervous and chronic coughs; and that it is useful in the palliative treatment of phthisis, in diminishing the hardness and frequency of the cough, in moderating the expectoration, and in favouring sleep.

It was first recommended as a remedy for stomach disorders in 1820, by Dr. Elliotson, in a paper entitled "Numerous Cases Illustrative of the Efficacy of the Hydrocyanic or Prussic Acid, in Affections of the Stomach; with a Report upon its Powers in Pectoral and other Diseases in which it has been already recommended."

In this paper, Dr. Elliotson gave brief notes of a series of cases in which pain in the stomach or vomiting was speedily removed by this medicine. It was soon tried by others with the same effect, and is now one of the medicines most in repute for the relief of pain in the stomach and vomiting.

It is not, however, in all cases of gastralgia, or in all cases of vomiting, that hydrocyanic acid can be given with advantage. In some cases, it aggravates pain in the stomach, or increases vomiting, or even brings it on when it did not previously exist.

It is of most service in the gastralgia, and in the sympathetic vomiting that occur in nervous persons from irritation elsewhere, without inflammation or ulceration of the coats of the stomach, and without undue secretion of gastric acid.

Given alone, or in conjunction with soda, it is the most effectual remedy we know of for the gastralgia that is apt to occur when the stomach is empty of food in nervous persons who have been subjected to exhausting influences; and for the vomiting that results from granular disease of the kidney.

It is of no use when pain or vomiting result from an inflammatory condition of the stomach.

It aggravates pain and vomiting when these symptoms are caused by an ulcer, or when they depend on excessive or untimely secretion

of gastric acid. It often, for example, increases the vomiting that occurs in phthisis, which alkalies and the vegetable astringents will prevent.

When there is undue acidity of the stomach it may, however, often be given with advantage in conjunction with soda or potash, when it would not be of service if given alone. The alkalies neutralize the excess of acid, and the sedative influence of the hydrocyanic acid is then exerted.

I have little to add to what I have already said respecting the other sedatives of the stomach.

Opium is especially useful in the vomiting that results from intemperance, or that occurs, with sleeplessness or troubled sleep, in persons exhausted by want of solid food, or by over-work, pain, or other depressing influences,—a kind of disorder that is not uncommon among the poor in our large cities.

When vomiting results from an inflammatory condition of the stomach, the most effectual sedatives are leeches, carbonic acid, and iced water.

Other medicines of great service in stomach disorders are the alkalies and the mineral acids.

The different alkalies have been long employed to correct undue acidity of the stomach; and when given in stomach disorders, it has been chiefly for the purpose of neutralizing a supposed excess of acid in the stomach. This seems to have been the purpose for which they were chiefly given, in cases of indigestion, by Prout. He says:—"It should be constantly borne in mind, that alkaline remedies have no effect in *preventing acidity:* their effects are solely confined to *neutralizing the acids already formed.*" He recommends, therefore, that they should be given three or four hours after a meal. In a subsequent chapter, he adds:—"If the proper time for taking alkaline remedies be attended to, it will be found, that a very small proportion of the remedy will, in all instances, be sufficient to accomplish the purpose; that is to say, from ten to twenty grains of the carbonate of potash will, in almost every case, be sufficient to counteract the acid residuum of the meal, which, in fact, is all the real good that can possibly be expected from the use of this remedy.

Dr. Holland expresses the same opinion. He says:—"As they (the alkalies) cannot fitly be termed a remedy for dyspepsia, but a relief merely to one symptom of the disorder, there is reason for closely conjoining their use with that part of digestion which it is the object to alter."

The soluble alkalies, potash and soda, have, however, more remote effects, by increasing the secretions of the liver and the kidney, and, perhaps, by otherwise modifying the processes of nutrition. Their general or constitutional influence is well shown by their curing eruptions, and by their efficacy in rheumatic fever and in gout.

The effect of soda is different from that of potash.

The salts of potash act more especially on the kidney. They have, I believe, little direct effect on the liver; but they are all of them—acetate of potash, nitre, bitartrate of potash—active diuretics. The very readiness with which they are eliminated by the kidney tends, no doubt, to lessen their direct action on other secreting organs.

The salts of soda, on the contrary, act more especially on the liver, increasing the secretion of bile, of which soda is a natural constituent, and are little esteemed as diuretics. The salts of soda exist in larger quantity than the salts of potash in the blood and in the animal fluids, and modify more directly morbid secretions from the mucous membrane of the air-tubes, and hence are of more general use as expectorants.

The salts of ammonia, again,—the sesquicarbonate, the acetate, the citrate,—act more especially on the skin. They have little direct action on the liver or the kidney, but are our most esteemed sudorifics.

In indigestion, soda is more generally useful than potash, probably from its more direct effect on the liver. The bicarbonate of soda alone, or in conjunction with rhubarb, or calumba, or gentian, has long been a favourite remedy in the stomach disorders of persons in the middle and upper classes of society who take too little exercise and live freely.

It is taken occasionally some hours after meals by most persons prone to acidity of the stomach and heartburn, for the mere purpose of neutralizing an excess of acid in the stomach, and, in the form of soda-water, is generally resorted to for the purpose of settling the stomach after a debauch.

In the kind of indigestion common enough in persons who take little exercise and live freely, that consists in impairment of appetite and nausea and disrelish for rich dishes, with a furred tongue, and defective action of the liver, and costive bowels, no remedy is more effectual than the bicarbonate of soda, in doses of fifteen grains, three times a-day, before meals, in conjunction with an occasional small dose of blue-pill to increase further the secretion of the liver

and with colocynth or aloes to keep up regular action of the large intestine.

If there be a sense of heat in the stomach, or if the secretion of urine be scanty, a few grains of nitre may be added to the soda.

Soda may be given at any time to neutralize an excess of acid in the stomach; but, as Dr. Prout remarked, it will not always prevent an excessive formation of acid; on the contrary, if it be given at improper times, it may, by weakening the digestive power, promote those fermentative changes in the food which lead to the abundant formation of lactic and other acids, and may thus cause an undue acidity of the stomach that would not otherwise exist. The gastric juice is, and ought to be, an acid liquid, and if its acidity be destroyed by an alkali its digestive power is suspended. It has been clearly shown in experiments on artificial digestion, that if the infusion of the mucous membrane of the stomach employed in these experiments be used with too little acid, digestion is slow and feeble; if it be used without any acid, no digestion takes place, and putrefactive changes ensue.

If, then, alkalies be given at the time of meals, or just before or soon after, to persons whose digestion is habitually slow and feeble, or to persons whose digestion has been weakened by the sympathetic disorder of the stomach that often results from a source of irritation elsewhere, the alkalies may still further weaken digestion, and do much mischief.

The fact that alkalies, improperly given, injure the stomach and weaken digestion, was emphatically noticed by Prout. He says: "The injudicious use and abuse of alkaline remedies in acidity of the stomach, is often a source of great mischief." "When taken in large doses, and at improper times, the effect of alkalies is to cause an absolute increase of acid. Thus, when a large quantity of alkali is taken into an empty stomach, the immediate effect is, that the stomach, in endeavouring to resume its natural condition, throws out an additional quantity of acid to neutralize the redundant alkali. When alkaline remedies, therefore, are injudiciously persisted in, a daily contest arises between the stomach and the doctor. If the constitution be sound, the stomach, in spite of the doctor, usually gains the ascendency, but at the expense of extraordinary labour in the secretion of a greater quantity of acid. If, on the contrary, the vital powers of the stomach be weak, the doctor may conquer, but at the risk of still further enfeebling the vital powers of that organ; and, in both instances, the general result will be, that the

diseased functions of the stomach, producing acidity, will be augmented rather than improved."

It is difficult, in the present state of our knowledge, to lay down more precise rules for the employment of alkalies. It may, perhaps, be adopted as a maxim, that alkalies, given to exert their constitutional effect, are most frequently useful to persons who have dry skins and perspire little, and eat largely of animal food and live in towns; that acids are most frequently useful to persons who live in the country, eat largely of vegetable food, and perspire much.

If there be one symptom more than another that suggests and justifies the use of soda, it is a furred or coated tongue.

LECTURE XVI.

On some of the remedies for stomach disorders—The mineral acids—The vegetable bitters—The preparations of steel—Purgatives—General rules of living.

THE mineral acids, especially the nitric and the muriatic, have of late years come much into vogue as remedies in certain forms of indigestion.

It was remarked by Heberden, that persons suffering from excessive acidity of the stomach are not always injured, and are sometimes even benefited, by acid drinks. He says:—

"Potus acidi non semper nocent ægris acore ventriculi laborantibus, non nunquam etiam auxilio sunt."

The good effects of acids were pointed out more distinctly by Pemberton. Speaking of the administration of alkalies, he says:—"This" (the giving alkalies) "is one method, and that the more common one, of endeavouring to destroy the abundant quantity of gastric acid. Sometimes, however, it abounds so much, that a greater quantity of alkali may be required to render it inert than can with propriety be administered internally; in which case complete relief is frequently obtained from the very opposite treatment, namely, by a more powerful acid."

The acid which Pemberton was in the habit of using is the nitric; which he gave in doses of five drops, every four hours, in cold water.

The good effects of acids in the treatment of some kinds of stomach disorder was subsequently fully established by Dr. Prout, who did more than any one else to bring these medicines into fashion.

Prout found them of especial efficacy in the gastric disorder that occurs in what he termed "the oxalic diathesis," and that is marked chiefly by distressing flatulence and palpitation or irregular action of the heart, occurring some time after meals, and by the presence of oxalate of lime in the urine.

The mineral acids are often useful to persons in whom digestion is habitually slow and feeble, from a scanty secretion of gastric juice, and who have a sense of weight or oppression at the stomach after meals.

They are often useful, also, as Pemberton showed, in the indigestion attended with excessive formation of lactic acid that occurs in weak and nervous persons, and when the stomach has been for some time disordered and weakened by a source of irritation elsewhere.

In other forms of indigestion, they are seldom of benefit. They do positive harm in the indigestion that results from organic disease of the stomach, or from an inflammatory condition of its mucous membrane, and generally do harm in the indigestion of gouty persons, and wherever the urine throws down a sediment of red lithate of ammonia or of lithic acid.

The mineral acids have a tendency to cause deposits of lithic acid in the urine, and can seldom be given with advantage when such deposits exist.

The injunctions of Dr. Prout on this point are very positive. Speaking of the remedies adapted to the ailments that result from the oxalic diathesis, he says:—"The effects of the mineral acids must be watched; and when they begin to produce a deposition of the lithate of ammonia, or of lithic acid, their use must be suspended. Indeed, in all instances, the mineral acids require to be left off after a time, as, when too long persisted in, they not only cease to do good, but in most instances do harm. In cases of this diathesis, where the patient lives at a distance in the country, I commonly recommend the use of the muriatic acid, (or nitro-muriatic acid, as the case may be,) to be persisted in till the lithate of ammonia, or the lithic acid, begins to appear in the urine, or for *a month;* and by adopting such a course of acids three or four times in the year, and by a carefully regulated diet, I have seen the diathesis gradually subdued, and at length removed altogether.

The mineral acids produce their effect, partly, perhaps, from their direct action on the coats of the stomach, and partly from their general tonic influence on the system at large.

The best time for giving them is half an hour or three quarters of an hour before meals.

Another class of medicines often of use in dyspepsia is that which includes the vegetable and mineral tonics.

The most important medicines of this class are the vegetable bitters,—quinine, gentian, calumba, strychnine,—and the different preparations of iron.

Quinine, and the bitters generally, are especially grateful to persons who have injured their stomachs by hard drinking. With such persons they improve the appetite and strengthen digestion, and have a bracing effect upon the system at large.

In persons exhausted by over-work, or wherever weakness of the stomach is the result of general debility from other causes, they often do much good in the same way—*by improving the appetite* and strengthening digestion.

They do harm in organic diseases of the stomach; in plethoric states of the system; and generally where there is a furred tongue, or where the urine throws down a sediment of lithic acid, or of lithate of ammonia. Their most striking effect is, to improve the appetite, when this has been impaired from hard-drinking, or from over-work, or from nervous exhaustion from other causes; and the best time for giving them is from half an hour to an hour before meals.

The different bitters have not precisely the same effect. Calumba has a sedative influence not possessed by the others, and probably on this account has had a wider reputation as a remedy for mere indigestion. Gentian and chiretta (which is of the gentian tribe, and is much employed by practitioners in India,) tend to increase the secretion of the liver, or at any rate do not impede the secretion of the liver, which quinine and quassia seem often to do. They are, therefore, better suited to bilious persons, and to those cases of indigestion where the secretions of the liver are defective.

The different preparations of steel are especially useful in the indigestion that occurs in chlorosis, and generally where weakness of the stomach results from anæmia.

They do harm in plethoric states of the system, and generally where there is a furred tongue, or where the urine throws down a sediment of lithate of ammonia or of lithic acid.

The citrate, or ammonio-citrate, is the most agreeable preparation to the taste, and generally the most grateful to the stomach.

If there be any disposition to sickness or nausea, or any tendency to furring of the tongue, it may be given in conjunction with the bicarbonate of soda or potash. This makes a mixture having much the same effect as Griffiths' mixture,—the mistura ferri composita,—and far more agreeable.

The muriated tincture of iron is more astringent than the other preparations, and may be given in conjunction with dilute muriatic acid, in the forms of indigestion suited to this latter medicine, when these exist in states of anæmia.

The sulphate of iron, like the other metallic sulphates, has a tendency to cause sickness, and should not be given in cases where a disposition to sickness exists.

Steel medicines do good by improving the quality of the blood rather than by their immediate action on the coats of the stomach, and are best given at meal-times. They then are mixed with the food, and gradually absorbed with the products of digestion, and are less apt to offend the stomach and to cause headache than at other times.

Whenever steel medicines are given, it is essential that a regular action of the bowels be kept up. These medicines tend to confine the bowels and to cause evolution of sulphuretted hydrogen in them; and, unless this tendency be counteracted, they are apt to fur the tongue and cause headache.

The choice of purgatives is a very important matter in stomach disorders. The different purgatives exert their chief action on different portions of the intestinal canal: some excite the secretion or the peristaltic movement of one part, some of another. In disorders of the stomach and bowels, where a purgative is required, care should, therefore, be taken to select that which is least prone to irritate the injured or disordered part.

Castor-oil, for example, offends the stomach, but acts very mildly on the large intestine. It should not be used in stomach disorders, or where, from any cause, a tendency to vomiting exists; but is better than any other purgative in dysentery or during convalescence from typhoid fever, when the intestines are ulcerated, and in various other conditions where a speedy and sure purgative, and one not apt to irritate the large intestine, is required.

Senna acts chiefly on the small intestine, and, besides exciting its peristaltic action increases the secretion from its mucous membrane. It acts, also, on the liver, increasing the secretion of bile. In conjunction with a few grains of calomel or blue pill, it is, as

every one knows, one of the best purgatives in bilious states of the system, or where an evacuant is required; but in mere disorders of the stomach, it is often objectionable, from the tendency it has to cause sickness.

The best purgatives in stomach disorders are aloes and colocynth, which exert their chief action on the large intestine. These medicines may do much harm when the large intestine is ulcerated or inflamed; but in simple ulcer of the stomach, and in the most severe functional disorders of the stomach, they may generally be given without causing either pain of the stomach or sickness. In some kinds of functional disorder of the stomach, aloes seems, indeed, like other bitters, to improve the appetite and strengthen digestion.

Aloes appears to act more exclusively on the large intestine, and to irritate the stomach less than colocynth, and hence, in stomach disorders, is generally preferable to it.

Where, from the existence of piles, or from pregnancy or some other condition, these medicines are objectionable, the best substitutes for them in stomach disorders are the saline purgatives, which exert their chief action on the small intestine, and have little tendency to cause pain in the stomach or sickness.

But, if much may be done to remedy the disorders of digestion by medicines suited to particular emergencies, still more may often be done to strengthen and improve digestion, especially with the overworked inhabitants of this great city, by horse-exercise; by occasional change of air and scene; by sea and other bathing; by rest and early hours;—by all conditions, in fact, which tend to invigorate the body, and which increase the power of digestion, as they often do the exhausted mental or muscular power, by improving the nutrition of the organ on which it depends.

Independently of such conditions as these, much may also be done to strengthen and improve digestion by certain general rules of living.

All writers on indigestion, from the time of Celsus, have, indeed, laid down general rules or maxims, the observance of which is calculated to render digestion more easy and perfect.

According to Sir Henry Holland, one of the best as well as latest writers on this subject, the most important of these maxims are the following:—

1. That the food should be well masticated.

2. That the stomach should never be filled to a sense of uneasy repletion.

3. That there should be no urgent exercise, either of body or mind, immediately after a full meal.

The importance of proper mastication has been long generally recognised, and might have been inferred from the existence of special organs for this purpose in some form or other, in all animals that eat solid food.

By mastication, the food is ground down and intimately mixed with saliva. The trituration of the food allows the gastric juice to act speedily on every particle of it on all sides, and so hastens that solution of it in the stomach in which stomach-digestion essentially consists. The chemist imitates the process when he grinds down in his mortar any hard and sparingly-soluble substance which he wishes to dissolve. The bird that feeds on hard grains, by an instinct more unerring than man's reason, swallows pebbles to increase the grinding power of its crop.

If the food be tough, and so escape proper trituration, or if it be swallowed in large morsels, through which the gastric juice cannot readily filter, it is dissolved in the stomach much more slowly, and tends to cause uneasiness of the stomach and all the other evils that result from slow and imperfect digestion.

There has been much difference of opinion respecting the uses of saliva. The first and most obvious use of it is, to lubricate the mass of food in the mouth, and so make it more easy to swallow. The quantity of saliva is in great measure determined by the need of it for this purpose. The more liquid the food, the less, *cæteris paribus*, is the secretion of saliva. The saliva must also serve to keep separate the particles of the triturated food, and thus expose them more fully to the action of the gastric juice.

Liebig, considering the great disposition which saliva has to froth, has rightly remarked, that it must convey into the stomach atmospheric air, and has suggested that a certain quantity of air, or rather of the oxygen it contains, may contribute to set in action, or promote the digestive process.

Besides these mechanical uses saliva has a chemical action on the starchy principles of the food. It has no solvent or digestive action on albuminous substances, but, like the pancreatic juice, it promotes the transformation of starch into sugar,—the first step in the series of changes which starch can undergo in the animal body.

Seeing that proper mastication may contribute to digestion in

various ways, it is obviously important, as regards digestion, that the organs of mastication be in a sound condition. If many of the teeth be wanting, the food may escape proper trituration. If the teeth be filthy, or be much decayed, the saliva, always prone to decomposition, very readily becomes fœtid; and the food intimately mixed with this saliva, like food tainted in other ways, is apt, in persons of weak digestion, to offend the stomach, and to undergo in the stomach common putrefactive changes, thus causing all the discomfort that arises from surfeit.

The second maxim, "not to fill the stomach to a sense of uneasy repletion," is more important than the maxim we have just considered, and more frequently broken. In the middle and upper classes of society, indigestion is too often, as a humorous writer termed it, "the remorse of a guilty stomach." The appetite is indulged, and more is habitually eaten than is required to nourish the body, or than the stomach can long continue to digest. The consequence is, that the stomach suffers, and that superfluous matters, including the hurtful products of imperfect digestion, pass into the blood, disorder the processes of nutrition in various parts of the body by polluting the nourishing stream, and often cause permanent change of structure in the arteries, and in the liver and the kidney, which serve to eliminate the superfluous matters from the system.

The sufferings of the stomach itself are but a small part of the ailments that habitual over-indulgence of the appetite brings on. Not unfrequently a vigorous stomach digests much superfluous food for a long time without pain or uneasiness, and the penalty of the indulgence is paid in occasional fits of the gout, or, more remotely still, in the various ailments that result from those permanent changes of structure that high living tends to bring on.

Experience has shown, that uneasy digestion more frequently results from excess in the quantity of food than from any fault in its quality,—a circumstance which our present knowledge of the process of digestion enables us fully to explain.

The gastric juice, out of the body, will dissolve the various kinds of food; but, as Spallanzani long ago remarked, it will dissolve only a limited quantity of any kind. When this limit is attained, the solvent power is expended. The digestive power may be restored to a certain extent by the addition of water or of free acid; but, to dissolve much more of the food, there must be a fresh quantity of the juice.

The stomach at any time can furnish only a certain quantity of gastric juice. If more food be eaten than this can dissolve, part of the food is imperfectly digested, and causes uneasiness of the stomach; and often the undigested food, as Dr. Beaumont has shown, excites in the mucous membrane an erythematous inflammation, which prevents the proper nutrition of the membrane and the restoration of the expended power.

Eating too frequently is equivalent to eating too much. When the power of the stomach is expended, it is gradually restored, like the intellectual power of the mind or the mechanical power of the muscles, by the nutrition of the organ on which it depends. For this restoration of power, whatever be its kind, an interval of rest is necessary.

The absolute quantity of food required to nourish the body varies greatly in different persons,—partly from inherited peculiarity of constitution, partly from habits of life and other conditions. The supply must equal the demand, so that no positive rules as to quantity can be laid down. In some persons, without any peculiarity that constitutes actual disease, the waste of the body is much greater, and what is eaten is less perfectly assimilated, and more food is consequently required than in others. The rule, therefore, laid down by Dr. Holland, not to fill the stomach to a sense of uneasy repletion, is much better than any positive rules as to the quantity of food. The quantity of food should clearly never be greater than the stomach can easily digest.

The third maxim, "that there should be no urgent exercise, either of body or mind, immediately after a full meal," merely enjoins obedience to a natural tendency, which man has in common with other animals. All alike have a disposition to rest when the stomach is full. Digestion requires an additional flow of blood to the stomach and an expenditure of nervous power, and goes on more slowly when the means of its support—the nervous influence and the blood—are needed elsewhere. Men who earn their living by bodily labour, and have digestive power to spare, may often violate this rule with impunity, but studious men, and men of feeble digestion, can seldom do so without aggravating their ailments. The work of digestion is quite as much as the system can well do at a time.

It is also important to easy digestion that the meals should be taken at proper times. With regard to the absolute time of meals, much depends on habit; and this again is often determined by the

custom of society or the needs of business. The man of business, to avoid working immediately after dinner, must dine late; the idle man must often dine alone, or he must dine late. Our legislators, who do their work at night, and people of fashion, who visit at night, must have little sleep, or they must breakfast late, and consequently, dine late. They are hardly free agents in the matter, as long as they follow the business, or enter into the social amusements, of their class.

The following rules are, I think, the best that can be laid down on this point:—

1. That the substantial repasts should be separated by an interval sufficient to allow the stomach to recruit its power.

2. That abstinence from food should never be so protracted as to induce a sense of exhaustion. Exhaustion from fasting, as from other causes, weakens the digestive power. If, then, the interval between breakfast and dinner be long, a light luncheon should be taken; if the dinner be in the middle of the day, a light supper should be taken.

3. A third rule is, that the last heavy meal should be some hours before bed-time.

The process of digestion, when it is easy and the food was required, favours sleep. But sleep renders digestion slower, and thus prolongs the irritation which uneasy digestion sets up; and the digestion of a heavy meal, by causing uneasiness in the stomach, and by furnishing superfluous or noxious matters to the blood, when from the greater slowness of respiration and secretion these are less readily consumed or excreted, often disturbs the sleep.

As Dr. Holland has remarked, much harm is done in this way by the lateness of the present fashionable hour of dinner. This is well suited to persons who are to spend great part of the night in the House of Commons or at a ball, in whom it prevents the exhaustion that would otherwise result from many hours of excitement; but it is a source of much mischief to persons whose occupations call them up in good time in the morning, and who must, consequently, spend their nights in sleep.

The food allowed to dyspeptics should not be too much restricted as to kind. The body requires a great number of principles for its healthy nutrition, and, unless these are furnished, the incessant waste of the body cannot be repaired. If the diet be too much restricted, some principle or principles may be wanting, which although

entering only in extremely small quantity into the composition of certain tissues, may yet be required for healthy nutrition.

The error most commonly committed on this point is to debar the patient from vegetable food. Persons who eat freely of milk, which seems to contain all the nourishing principles of both animal and vegetable food, may abstain with impunity from fresh succulent vegetables and fruits; but persons who eat sparingly of milk, as dyspeptic persons often do, from inability to digest it, cannot long abstain from succulent vegetables, or their preserved juices, without falling, in some degree, into that faulty state of nutrition that constitutes scurvy.

The best diet is, generally, a mixed diet of animal and vegetable food; and this may be sufficiently varied, without including the more unwholesome articles of the two classes.

Persons of weak digestion should abstain from veal and pork, and from all salted, dried, or smoked meats, which experience has shown to be particularly hard of digestion.

They should also abstain from new bread, which is apt to ferment and expand in the stomach: and from peas, beans, and other vegetables which are hard to digest and have an especial tendency to cause flatulence. With such restrictions as to the kind of food, and with the restrictions as to quantity which I have before mentioned, the patient may generally be allowed to follow his own desires.

On the question of drinks it is still more difficult to lay down positive rules. Much has been written of late respecting the effects of alcoholic drinks, and opinion is still divided on the use and abuse of them. The following points seem, however, to admit of no reasonable doubt.

1st. That alcoholic drinks, by the stimulus and support they furnish, are of great service in various diseases attended with exhaustion or depression; or in which there is inability to digest solid food.

2nd. That the habitual use of them in moderate quantity is often beneficial to persons whose occupations are exhausting or depressing; or who have long been accustomed to such stimulus.

3rd. That by the mass of mankind, high and low, they are drunk to injurious excess.

In persons who suffer from indigestion, if taken at all, they should be taken in very moderate quantity, and only at the time of meals,

or soon after. If taken when the stomach is empty, they stimulate the stomach when it has no work to perform, and are absorbed more rapidly, and are consequently more apt to cause disorder in the head and elsewhere than at other times.

The quantity that can be taken with advantage, or without injury, varies greatly in different persons, according to the constitution, the size of the body, the mode of life, and the previous habits. Any quantity is hurtful that oppresses the head, or makes the skin hot, or disturbs the sleep.

The effect of the different fermented drinks, when taken to excess, differs greatly.

The distilled spirits do the greatest direct injury to the stomach and the liver. The victims of spirit-drinking frequently die of organic disease of the stomach, or of that disease of the liver which is here fitly called the gin-drinker's liver; but they suffer little from gout.

The heavy malt liquors, probably from the greater dilution of the spirit, have little disposition to inflame the stomach or the liver, but have an especial tendency to bring on gout. No men are such melancholy victims of gout as men of the lower classes in London, who make their hard work an excuse for drinking enormous quantities of porter.

Wines are free from the strongest objections to both these classes of drinks. They have much less tendency than spirits to damage the liver, and much less tendency than malt liquors to bring on gout.

All seem to be intoxicating in proportion to the quantity of spirit they contain. All, therefore, if taken to excess, injuriously affect the brain.

These leading facts respecting the different effects of alcoholic liquors, may serve, in some degree, to guide us in prescribing one or the other of them.

Spirits, and the drier wines, are best suited to gouty persons, or to men in the middle of life who are of gouty families, or whose mode of living disposes to gout,—persons who would do well always to abstain from heavy malt liquors.

Malt liquors, from containing more of the elements of nutrition, are especially suited to agricultural labourers and others whose work is hard, and whose diet is scanty and not sufficiently varied.

The liquor that is most generally wholesome is wine.

Tea and coffee are not open to the same objections as fermented drinks, but they are doubtless commonly taken to very injurious

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